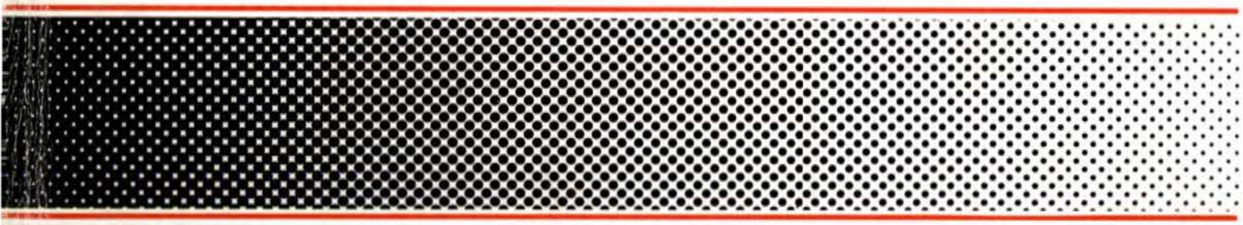

OKIDATA®

Microline 320/321
Epson®/IBM® Compatible
Reference Guide

OKIDATA

MICROLINE®
320 AND 321

Reference Guide

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▶ Introduction

There are two ways you can control the many features of your ML320/321:

- Through the front panel.
- Through your computer, using either commercial software or programs you've written yourself.

This Reference Guide tells you what you need to know to take full advantage of your printer's capabilities using either of these methods.

Chapter 1, "Front Panel Control," gives a brief overview of how to use the printer's front panel to change printing features, both directly and through the Menu Select mode. This information is covered more thoroughly in the Setup Guide.

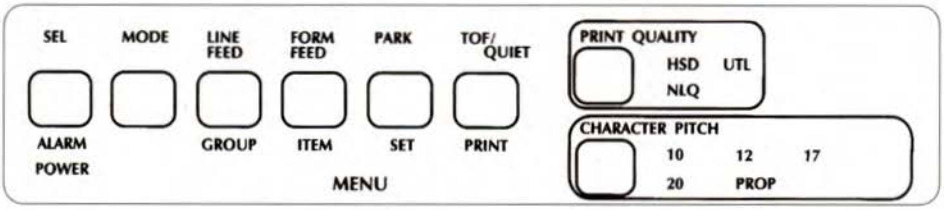
Chapter 2, "Computer Control," tells you how to use the features of your software to control the printer. It contains general guidelines on installing and using software with your printer, as well as specific information on PC/MS-DOS. You'll also find tips on BASIC if you want to write your own programs.

Chapter 3, "Control Code Reference," provides details on all of the printer's features and the commands that control them. This chapter will be useful even if you don't do your own programming, because it contains information about how the printer features work and how to use them.

Chapter 4, "Graphics and Custom Characters," is not for the faint of heart. It describes how to program graphics and custom (downloaded) character sets, and these are complex, time consuming jobs.

There are also a number of appendices at the end of the book containing reference material on control codes, character sets, interfacing, and product specifications.

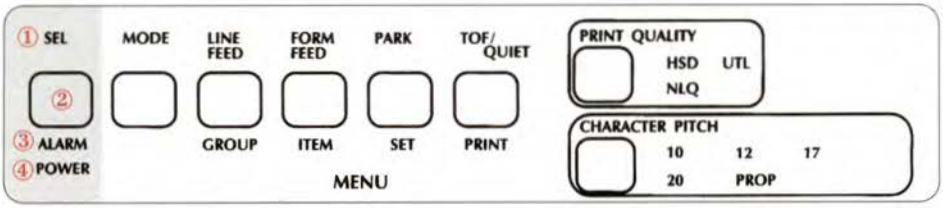
▶ Chapter 1: Front Panel Control



The ML320/321's control panel gives you fingertip command over most of the printing features that affect the look of your documents. You can change basic features of each document straight from the panel. Using the Menu Select mode—entered directly from the panel—you can alter the default settings of other features.

Note All buttons on the control panel are active regardless of whether the printer is selected or deselected.

Basic Controls



1. **SEL light**: When this light is ON, the printer is selected and ready to receive data from the computer. When the light is OFF, the printer is deselected and cannot receive data.

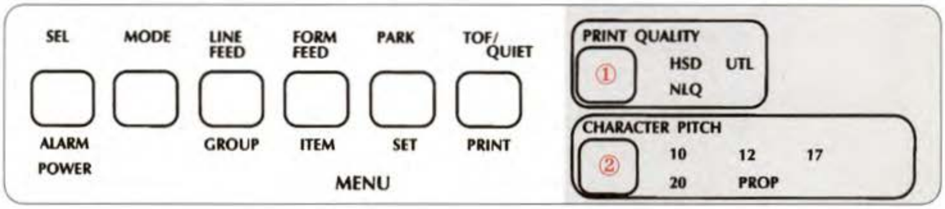
   When the light is blinking, the printer is in Print Suppress condition and will ignore all data until the Print Suppress condition is turned off. (See page 53.)

2. **SEL button**: Push this button to select or deselect the printer (SEL light is ON or OFF).
3. **ALARM light**: This light indicates either that paper is out or that there is an internal problem requiring service.
4. **POWER light**: This light indicates that the printer is turned on.

Print Characteristics

These buttons let you control basic printing features without modifying your software. Simply press a button until the selection you want lights up. You can change features when the printer is either selected or deselected.

Note This part of the panel always reflects the state of the printer; if your software changes one of these features, the corresponding light will change, too.



1. **PRINT QUALITY** NLQ: Near Letter Quality. The highest level of print quality for your most important documents. UTL: Utility. Higher speed printing for internal documents and high-volume data printing. HSD: High Speed Draft. Highest speed printing for drafts.

2. **CHARACTER PITCH** 10, 12, 17, 20: These determine the width of the characters, indicated in characters per inch (cpi). PROP: Proportionally spaced, not available in HSD.

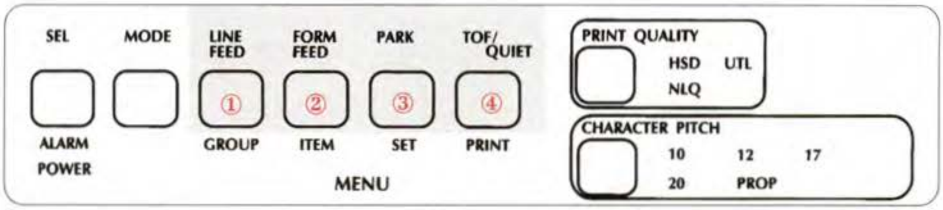
The MODE button

This button controls the functions of the next four buttons on the panel by switching the printer between Print mode and Menu Select mode. When the printer is in Print mode, the functions shown above the buttons are active; this is the state of the printer when you turn it on. When the printer is in Menu Select mode, the MENU indicator lights, and the functions shown below the buttons are active—this lets you customize the default settings for a number of printer features directly from the control panel.

Print Mode

1. **LINE FEED button**: Press this button to advance the paper one line.
2. **FORM FEED button**: Press this button to advance the paper to the first print line of the next page.
3. **PARK button**: Use this button with continuous-form paper. When you press it, the paper retracts from the front of the printer so you can use single sheets without completely removing the continuous forms. (See page 17 of the Setup Guide for details.)
4. **TOF/QUIET button**: When the printer is deselected, press this button to set the position of the first print line on the page ("top of form").

When the printer is selected, press this button to enter the Quiet mode ("QUIET" lights on the panel). This mode reduces the sound produced by the printer by printing in two passes instead of one. Return to normal operation by pressing the button again with the printer selected.



Menu Select mode

In this mode, you can customize your printer so that the features you want are automatically active when you turn it on. The selections you make on the menu are stored in the printer's permanent memory and, in effect, become default settings, although they can be changed through software commands, through the control panel, or through resetting the menu.

Note

You can override features set on the menu using either the front panel or commands sent from your computer. However, when you turn off the printer, features set by those methods will be cancelled. Features set on the menu will stay in effect, even when the printer is turned off.

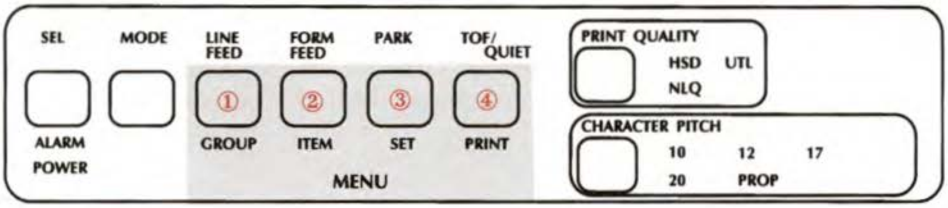
To enter Menu Select mode:

Make sure the printer has ribbon and paper.

Press MODE.

The SEL light goes out and the MENU light goes on, indicating that the menu functions, listed below the print mode buttons, are active. If you want to print out the entire menu with its current settings, press the PRINT button. When you are ready to start changing settings, press GROUP, and the first line of the menu prints. Here's how it's arranged:

`Font`	`Print Mode`	`Utility`
GROUP of related items	ITEM within the group	Current SETting for the item



When the MENU light is on, the bottom button functions are active:

1,2,3: Press these buttons to move to the next GROUP, ITEM, and SETting, respectively.

4: Press this button at any time to print a complete listing of the menu with its current settings.

Note

We recommend that you print out the menu whenever you change it to keep for reference.

When you've made the changes you want, press MODE to record the changes and return to Print mode. (MENU light goes out.) Appendix B gives a complete listing of menu items and factory settings. A detailed explanation of the menu items begins on page 42 of the Setup Guide.

Note

To return the menu to its factory settings, hold down the MODE and SEL buttons while turning on the printer.

To return the menu *and* the stored top of form to their factory settings, hold down the PARK and TOF/QUIET buttons while turning on the printer.

▶ Chapter 2: Computer Control

This chapter explains the basics of controlling the printer through your computer. It covers the fundamentals of setting up a software package for use with your printer, MS-DOS printing commands, and provides some tips on writing BASIC programs to control your printer. This information should help you get started; be sure to read your software documentation carefully for more details.

Commercial Software

Most of the time, your printer will be controlled by standard commercial software packages such as WordStar, Lotus 1-2-3, WordPerfect and the like. For your convenience, a brief explanation of how to use your printer with some of these programs is provided below. It must be emphasized, however, that the software documentation is the final source for this information, and some details may have changed as we go to press. Consult your software manual before attempting to install your printer.

Selecting Drivers

Commercial software packages use printer *drivers* to control the appearance of printed documents. A driver is simply a list of commands that will make a specific printer perform various functions at the request of the software. It operates much like a translation. If the software is to underline some text, for example, the entry for underlining is "looked up" in the software driver, and the command listed there is sent to the printer. Use of drivers makes it possible for a program to function roughly the same way no matter which printer has been selected.

Many of the packages you will use will contain drivers for the ML320. For older software, however, it may be necessary to select a driver that functions *nearly* the same as an ML320 driver. Because command sets tend to grow in "families," this generally means that you will be selecting a driver that provides access to fewer functions, but the commands available will perform properly with your printer. Your printer is an Epson/IBM emulation version. Following is a list of the drivers you can choose in the two emulations.

Printer Compatibility

IBM	Epson
Proprinter II/XL	FX86/286
Graphics Printer	FX
	EX800/1000

Selecting a driver for your software is usually a part of the program installation process. Changing printers may require use of an external routine, or may be possible through menu selection. Following is a list of commonly used commercial software packages and the routines or methods used to install and change printers:

Software Driver Selection

Package	Intallation/Modification
WordPerfect	Install from DOS command line with WP/S; modify with PRINTER
WordStar 3.x	WINSTALL
WordStar 4.x	WINSTALL/WSCHANGE
WordStar 2000	WS2INS
Microsoft Word 3.0	Select PRINT then OPTIONS; press F1 to list printers.
DisplayWrite 4.0	INSTALL
Multimate	UTIL
PFS Professional Write	Select SETUP then SELECT PRINTER from menu.
Lotus 1-2-3	INSTALL
Lotus Symphony	INSTALL

SuperCalc 3 and 4	Select GLOBAL then GRAPHICS then DEVICE from menu.
DBase II & III	Send print commands directly to printer in programming mode.
PFS Professional File	Select SETUP then SELECT PRINTER from menu.
Harvard Graphics	Select SETUP from configuration menu; then choose printer
PC Paintbrush	PCINSTAL
Harvard Total Project Manager 2.0	Select SETUP then PRINT/PLOT (F2). Select 1 from menu for text printer; 2 for graphics printer.
SuperProject Plus	Press ALT-4 then CTRL-D. Enter Driver location. Select.
Microsoft Windows 2.03	Select PRINTER when configuring the system with SETUP, or at any time by running the Control Panel (CONTROL.EXE) and selecting SETUP, then PRINTER.
GEM	Open the GEMSYS folder. Select SETUP.APP. Highlight CATEGORIES and select printers and move it to the CHOSEN PRINTER along with fonts.

Because there are some differences in characteristics such as speed or access to various features, you may wish to experiment with several different drivers. If you must select a driver that is not on these lists, be sure to check it thorougly for print features such as boldface, underline and changes in pitch. Don't be suprised if boldfaced items are printed twice, underlines are misplaced, wide spaces are left between lines or the printer behaves chaotically (turn off the printer if the latter occurs). These are all characteristics of an incompatible driver selection.

Driver Modification and Embedded Commands

In some cases, commercial software packages will permit you to create and/or modify the printer driver. Even if a ML 320 driver is available, this option can provide considerable room for customization. Typically, the driver modification routine will present a list of operations with some method for entering printer commands in decimal, ASCII, or hexadecimal form. This permits substitution, such as entering the italic command in place of the underline command. It also permits modification of an existing driver, such as for the Epson FX, to better fit the ML 320. Driver modification does require a basic familiarity with your printer's command set, so you should study chapter 3, "Control Code Reference," thoroughly before attempting it.

Some programs also permit you to control your printer directly through embedded commands. These are printer commands placed within the text manually without specifying a printer operation. Usage of these commands in programs like WordPerfect can provide access to a wide range of printer capabilities that are not ordinarily supported, or, in programs like Lotus 1-2-3, printer commands can be entered as an initialization string to set the basic format for a document. Again, a basic familiarity with your printer's command set is recommended. You should also remember that the commands themselves may be invisible or hard to decypher when the document appears on your screen.

DOS 2.0 and higher

Most IBM PC and compatible personal computers use PC-DOS or MS-DOS as their operating system. Although DOS is much more limited in printing capabilities than word processing or graphics software, there are some commands in DOS 2.0 and higher that you can use to control your printer. For best results, only print ASCII text files from DOS. You cannot enter printer control codes from the keyboard.

DOS commands for printing text files

- `PRINT filename`
- `TYPE filename > devicename`
- `COPY filename devicename`

If you've used a word processor or other software package to prepare your document, it's usually easiest to use that package's print commands to print it. This is particularly true if the software lets you control a document's appearance—page length, margins, printing features, and so on.

However, if your software doesn't control these kinds of features, it's just as easy to print using DOS commands. Some packages even have a "print to disk" feature, so you can save the file on a disk in a format that DOS can later read and send to the printer.

PRINT

PRINT is a background utility that lets you print a file while you're running another program. Once you've given the command to print your file, you can go on to another task on your computer, without waiting until printing is finished.

Note PRINT is not a DOS command but a separate program, so if you want to use it, the file PRINT.COM must be on one of your disks.

Example

In this example, we're going to print a file called NOTES.TXT, which is on the WORK subdirectory of the computer's hard disk drive (drive C:). The PRINT.COM program file is in the main (root) directory of the C: drive.

Begin by typing the following at the C> prompt:

```
PRINT C: \WORK \NOTES.TXT [RETURN]
```

You'll see this display on your screen:

```
Name of list device [PRN]:
```

If your printer is connected to the LPT1: parallel printer port, just press [RETURN]; if it's connected to another port (LPT2:, COM1:, or COM2:), type the name of the port and press [RETURN].

Next you'll see this display:

```
Resident part of PRINT installed C: \
WORK \NOTES.TXT is currently being printed
```

And the file will print.

Note If you're not sure which printer port your system uses, try pressing return to specify [PRN]. The device name PRN refers to LPT1:, the default DOS port. This is the port most printers are connected to.

Once you've used PRINT during a work session, DOS will "remember" the device you specified and won't have to ask you again where the printer is. Of course, turning off the computer or restarting it will erase this information from memory.

TYPE

If you don't have a copy of PRINT.COM available, you can use TYPE, redirecting the file to your printer. If you're not using LPT1: as your printer port, substitute the name of your port for LPT1 in our example.

Example

```
TYPE C: \WORK \NOTES.TXT > LPT1:
```

COPY

Just as you use this command to copy a file from one disk or directory to another, you can copy a text file to the printer. If you're not using LPT1: as your printer port, substitute the name of your port for LPT1 in our example.

Example

```
COPY C: \WORK \NOTES.TXT LPT1:
```

Changing the default printer port

If your system doesn't use LPT1: to connect the printer to the computer, you can specify which port DOS should use as its default. At the DOS prompt, enter the appropriate MODE command(s).

- For a serial interface, first enter:

  ```
  MODE COM1:9600,N,8,1,P
  ```

  Then enter:

  ```
  MODE LPT1:=COM1:
  ```

- For a parallel interface, enter:

  ```
  MODE LPT2:
  ```

Note The serial interface board is an option for the Microline 320/321 printer. See your dealer for ordering information.

If your serial interface is COM2:, replace COM1: in the commands shown above with COM2:. Likewise, your parallel interface may be LPT3:, in which case, change the MODE command to MODE LPT3:.

To avoid having to reenter the MODE command(s) every time you reset the computer, enter them in your computer's AUTOEXEC.BAT file. To create an AUTOEXEC.BAT file or edit an existing one, use a text editor or a word processor in a mode that allows you to create ASCII text files. If you're editing your system's AUTOEXEC.BAT file, be sure not to change or delete anything already in the file.

For more information on working with AUTOEXEC.BAT files, see your DOS manual.

BASIC programming

The LPRINT command in BASIC makes output go to the printer rather than to the screen. To send text to the printer, simply enclose the words in double quotes:

```
LPRINT "A line of text"
```

The statement above prints the line of text, and then moves the printing position to the beginning of the next line. If you don't want this automatic carriage return and line feed, put a semicolon (;) after the data:

```
LPRINT "A line of text";
LPRINT " ...and this text is on the same line"
```

For serial printers

If you're using your printer with a serial interface, you have to be sure to redirect output from the computer to the serial port you're using, either COM1: or COM2:, rather than to the default port, LPT1:. There are two ways to do this:

1. If you're using DOS, you can use the MODE command, as described on page 15. Then use the LPRINT command in your BASIC programs, just as we do in our examples.
2. You can also redirect output to COM1: or COM2: from within BASIC, by opening the port as a file and printing your data to that file. If you want to run any of our sample programs, you'll need to modify them. At the beginning of your program, include one of these statements:

   ```
   OPEN "COM1:9600,N,8,1" AS #1
   or
   OPEN "COM2:9600,N,8,1" AS #1
   ```

   Then, to print data, use the PRINT#1 command, being sure to include a comma between the #1 and the data:

   ```
   PRINT#1,"A line of text"
   ```

   Like the LPRINT command, PRINT#1 automatically moves the print position to the next line unless you use a semicolon (;) after the data.

When you send an LPRINT statement, the text between the quotation marks is converted to a string of numbers, which are then processed by the printer and output as the dot patterns that make up the individual characters. Each character is assigned a numeric value according to the American Standard Code for Information Interchange (ASCII). Since ASCII is a standard coding system, most computers, printers and other electronic devices can interpret ASCII data.

There are 256 ASCII codes. The codes from 0 to 127 are completely standardized (with a handful of minor exceptions), while those from 128 to 255 are used in a less standard way to represent a variety of special characters. The table of ASCII codes in appendix C shows the low ASCII codes from 0 to 127.

Although most of the ASCII codes represent alphanumeric and punctuation symbols, you'll notice that the codes from 0 to 31, as well as 127, don't correspond to normal characters. These are control codes, special characters used to control a wide range of peripheral equipment, from monitors to modems to the devices that interest us here, printers.

One of the most important control codes is the ESC character, decimal 27, hexadecimal 1B. Many of the more complicated commands begin with ESC, which serves as a signal to the printer that what follows is to be interpreted as a command rather than just a string of characters.

Since the control codes don't represent any character on your keyboard, you can't send them to the printer enclosed in double quotes, as you would with text. Instead, you have to use the CHR$ function, which lets you send the decimal or hexadecimal value for a character. For example, the escape character is represented as CHR$(27), or, in hexadecimal, as CHR$(&H1B). (Notice that hexadecimal numbers in BASIC are preceded by &H to distinguish them from simple letters or decimal numbers.)

Of course, you can also use the CHR$ function to output printable characters; for instance, CHR$(65) represents the letter A. However, it's usually easier to type letters, numbers and punctuation marks, and your BASIC programs will be much easier to read if you use literal characters, enclosed in quotes, wherever possible.

Some printer commands expect you to supply a numeric value, representing tab stops, line spacing, etc. These values can be entered by using the CHR$ function. Note that features which can be switched on or off with 1 and 0 can use either a literal numeral—"1" or "0"—or the value in a CHR$ function— CHR$(0) or CHR$(1).

▶ Chapter 3: Control Code Reference

This chapter describes the ML320/321's printing and formatting features and the codes that control them. It's not just for programmers; if you want to modify your software to add a particular function, or if you want to embed extra commands in a document, you'll find the necessary information here. Even if you just use the front panel to control your printer, the explanations of the features and how they work will be helpful.

In this chapter we list each control code first in ASCII notation and then using the decimal equivalents. The control code table in Appendix A includes the hexadecimal equivalents.

Because the ML320/321 can emulate two printers, there may be two different ways to control a particular function, depending on the emulation you've selected from the menu. To make sure you know which one to use, we've marked the commands with letters to indicate which emulation they apply to:

E = Epson® FX86e/FX286e
P = IBM Proprinter® II/Proprinter XL

In many cases, both use the same commands. Details on specific emulations fall under appropriate headings; these separate sections only appear when there are differences between the emulations.

Character style

Print quality

Select NLQ/Utility print quality	E

ESC x n
27 120 n
n=1: Select NLQ
n=0: Select Utility

Select high speed draft character set	E

ESC (n
27 40 n
n=0: Select HSD
n=1: Deselect HSD

Epson

Use High Speed Draft (HSD) or Utility printing for drafts and other documents that you want to print quickly. HSD is faster and its characters somewhat rougher than Utility. NLQ (near letter quality) printing is slower than Utility, but the characters are crisper and more like the characters produced by a typewriter. Use NLQ for final drafts and important documents where appearance matters.

Your printer's front panel or the Menu Select mode can also select print quality.

Select high speed draft character set	P

ESC # 0
27 35 48

IBM

You can use this command to specify High Speed Draft printing. For NLQ or Utility printing, use the ESC I command. (See page 30.)

Emphasized and enhanced printing

Begin emphasized printing ESC E 27 69	E P
End emphasized printing ESC F 27 70	E P
Begin enhanced printing ESC G 27 71	E P
End enhanced printing ESC H 27 72	E P

Your printer produces bold type by printing each dot of a character twice instead of once. In emphasized printing, the pairs of dots are offset horizontally; enhanced printing is produced with a vertical offset.

You can combine enhanced and emphasized printing for an especially bold effect. For headlines, try using them in combination with double width characters; you can also combine emphasized printing with double height characters. (See page 27.)

Epson

In the Epson emulation, you can also use the ESC ! command to specify emphasized or enhanced printing. (See page 30.)

```
Select typeface                              E
     ESC k n
     27 107 n
     n=0: Courier
     n=1: Sans Serif
```

Epson

This command allows you to select a letter quality typeface. The Courier typeface is your printer's default. You can also use Menu Select mode to select Courier or Sans Serif type.

Italics

```
Begin italics                                E
     ESC 4
     27 52

End italics                                  E
     ESC 5
     27 53

Begin italics                                P
     ESC % G
     27 37 71

End italics                                  P
     ESC % H
     27 37 72
```

Italic printing is slanted, *like this*, and is used to lend emphasis to phrases, sentences or entire paragraphs.

If you intend to print an entire document in italics, you may choose to select this printing style in Menu Select mode.

Epson

Note that in the Epson version of these escape sequences, the numerals are not ASCII codes 4 and 5, but rather the characters "4" and "5"—ASCII codes 52 and 53.

You can also use the ESC ! command to specify italic printing. (See page 30.)

Character size

Character pitch

Begin 10 cpi (Pica) ESC P 27 80	E
Begin 12 cpi (Elite) ESC M 27 77	E
Begin 10 cpi (Pica) DC2 18	P
Begin 12 cpi (Elite) ESC : 27 58	P

Character pitch, or width, is measured in characters per inch (cpi). For example, at 10 cpi, each character is $\frac{1}{10}$ inch wide. The double width and compressed printing commands interact with the basic pitches listed above to produce a range of character widths. See the "Character Width Values" table below for all possible widths.

Pitch can also be set in Menu Select mode or on the printer's control panel. In addition, pitch is one of the features available through the print mode combination commands in both the Epson and IBM emulations. (See page 30.)

Character width values

Pitch	Double width	Compressed *
10 cpi	5 cpi	17.1 cpi
12 cpi	6 cpi	20 cpi
17.1 cpi	8.5 cpi	Cannot be compressed
20 cpi	10 cpi	Cannot be compressed

*These compressed width values apply to the Epson emulation only. In the IBM emulation, the SI command produces 17.1 cpi. See page 26.

Proportional spacing E

ESC p n
27 112 n
n=1: Begin proportional spacing
n=0: End proportional spacing

Proportional spacing P

ESC P n
27 80 n
n=1: Begin proportional spacing
n=0: End proportional spacing

Proportional spacing adjusts the space between letters to compensate for the varying widths of individual characters. Unlike fixed spacing, where all characters are formed within a matrix of uniform width at a specified pitch, proportional spacing gives more horizontal space to wide characters, like w or M, and less to narrow characters, like I or f. The resulting print is more attractive and easier to read than fixed-space printing.

Because the characters have different widths, proportionally spaced fonts have no fixed pitch; therefore margin settings are only approximate unless your software specifically supports proportional spacing.

Proportional spacing is available only with near letter quality (NLQ) and Utility printing.

You can also select proportional spacing in Menu Select mode or on the printer's control panel. In addition, proportional spacing is one of the features available through the print mode combination commands in the Epson and IBM emulations. (See page 30.)

Note Appendix C contains a table of character widths for proportionally spaced fonts.

Double width

Double width printing E P
ESC W n
27 87 n
n=1: Begin double width printing
n=0: End double width printing

Begin one-line double width printing E P
SO
14

Begin one-line double width printing E
ESC SO
27 14

End one-line double width printing E P
DC4
20

Use these commands to produce characters twice as wide as regular characters. For example, if the current character pitch is 12 cpi, double width characters will print at 6 cpi. The "Character Width" table on page 24 shows all the possible combinations.

The one-line double width commands are especially convenient for titles and headlines, since they turn off double width printing automatically at the end of the line. If you want to cancel one-line double width printing before the line ends, send a DC4 or ESC W 0 command. (But note that when you use ESC W 1 to turn on continuous double width printing, the only way to stop it is with ESC W 0; DC4 has no effect.)

You can also choose continuous double width printing in Menu Select mode.

Epson

The one-line double width command ESC SO is identical in function to the SO command.

You can also select continuous double width printing with the ESC ! command. (See page 30.)

Compressed printing

Begin compressed printing SI 15 Epson: depends on current pitch IBM: prints in 17.1 cpi if current pitch is 10 cpi	E P
Begin compressed printing ESC SI 27 15 Depends on current pitch	E
End compressed printing DC2 18	E

Epson

The SI and ESC SI commands function identically. If the current pitch is 10 cpi, the compressed printing command will produce 17.1 cpi printing. With a current pitch of 12 cpi, compressed printing is 20 cpi.

When you send the DC2 command, the printer will return to whatever basic pitch was in effect before you began compressed printing.

IBM

SI produces 17.1 cpi only if the current pitch is 10 cip. To turn off compressed printing in the IBM emulation, send one of the basic pitch commands (See page 23.)

Double height

Double height printing E
    ESC w n
    27 119 n
    n=1: Begin double height printing
    n=0: End double height printing

Double height printing P
    ESC [@ EOT NUL NUL NUL n1 n2
    27 91 64 4 0 0 0 n1 n2

Double height printing produces characters that are twice as tall as normal size characters. It can be combined with double width and emphasized printing for an even more striking effect.

When you use double height printing, you'll probably need to adjust the line spacing to accommodate the taller characters.

Epson

Begin double height printing by replacing n with 1, and return to normal height printing by using 0 in place of n.

To adjust for the height of the taller letters, use the line spacing commands described on page 46.

IBM

This command lets you specify character width and line spacing in addition to character height. The various combinations of these three features are determined by the values given to the variables n1 and n2, with n1 controlling character height and line spacing and n2 controlling character width.

Values for n1 (IBM)

Value	Result
0	Current line spacing and character height
1	Current line spacing, standard character height
2	Current line spacing, double character height
16	Single line spacing, current character height
17	Single line spacing, standard character height
18	Single line spacing, double character height
32	Double line spacing, current character height
33	Double line spacing, standard character height
34	Double line spacing, double character height

Values for n2 (IBM)

Value	Result
0	Current character width
1	Standard character width
2	Double character width

Example (IBM)

To use double height characters with double the normal line spacing, without changing the width of the characters, use this BASIC statement:

```
LPRINT CHR$(27);"[@";CHR$(4);CHR$(0);CHR$(0);CHR$(0);
CHR$(34);CHR$(0)
```

Print features

Underlining	EP

ESC - n
27 45 n
n=1: Begin underlining
n=0: End underlining

This command underscores all characters, including the space character, but does not underscore graphics or the space produced by any horizontal positioning command, including the horizontal tab character.

Epson

You can also use the ESC ! command to specify underlining. (See page 30.)

Overscore	P

ESC — n
27 95 n
n=1: Begin overscore
n=0: End overscore

IBM

This command prints a continuous line over all characters, including the space character, but does not overscore the space produced by a horizontal tab command.

Superscripts and subscripts

Begin superscript/subscript E P
ESC S n
27 83 n
n=1: Begin subscript
n=0: Begin superscript

End superscript/subscript E P
ESC T
27 84

Superscript characters are printed above the normal print line, and are used for exponents and special typographic effects (x^2). Subscripts are handy for chemical formulas (H_2O).

Superscripts and subscripts will print as full-width characters. Superscripts and subscripts cannot be used with double height printing.

Combined Commands

Print mode combinations E
ESC ! n
27 33 n
n=0 to 255

Print mode combinations P
ESC I n
27 73 n
n=0 to 7

These commands provide a shortcut for specifying combinations of features in a single escape sequence. However, the two versions—Epson and IBM—differ both in the features accessible through the command and in the way you specify those features.

Epson

The Epson command lets you use any combination of the features listed in the table below. To determine the value of n, add up the values for all the features you wish to use. To turn off all these features and return to 10 cpi printing, substitute 0 for n.

Epson Print Mode Combinations

Feature	Value
Underline	128
Italics	64
Double width	32
Enhanced	16
Emphasized	8
Compressed	4
Proportional	2
Elite (12 cpi)	1

For example, to print underlined italics at 12 cpi, assign n the value 193 (128 + 64 + 1).

Each time you send the ESC ! command, it sets or cancels the values for all nine of the features it controls (the eight features listed in the table, plus 10 cpi). This means that if you've requested 12 cpi underlined italics, and then want to add emphasized printing to these features, you must add 8 (the value for emphasized print) to 193 and send the command as: ESC ! 201. Just sending ESC ! 8 would turn off all the other features as it turned on emphasized print.

Example (Epson)

To see the range of print styles you can produce with ESC ! n, run the following short BASIC program, which prints a sample of each possible combination. (Since the program prints all 256 combinations, it will take a few minutes and about 12 pages for the entire sample to print.)

```
10 FOR I=0 TO 255
20 LPRINT:LPRINT
30 LPRINT CHR$(27);"!";CHR$(I);"ESC !";I;" selects this
   combination."
40 NEXT I
```

IBM

This command allows you to select print quality and character spacing for either resident or downline loadable (DLL) fonts. Substitute a value for n from the Print Mode Combinations table below.

IBM Print Mode Combinations

Value of n	Print mode
0	10 cpi utility
1	12 cpi HSD
2	NLQ Sans Serif
3	NLQ Courier
4	10 cpi DLL utility
5	12 cpi DLL utility
6	NLQ Sans Serif DLL
7	NLQ Courier DLL

For more information on DLL fonts, see page 65.

Character Spacing

Set character spacing E
ESC SP n
27 32 n
n=0 to 127

Set character spacing P
ESC V n
27 86 n
n=0 to 11

Use this command to adjust the amount of space to the right of each character. This value is expressed in dots; the number of dots per inch depends on the current print mode, as shown in the Character Spacing Increments table below.

Character Spacing Increments

Print mode	Dots per inch (dpi)
High speed draft	100
Utility	120
Near Letter quality	240

Character sets

International characters

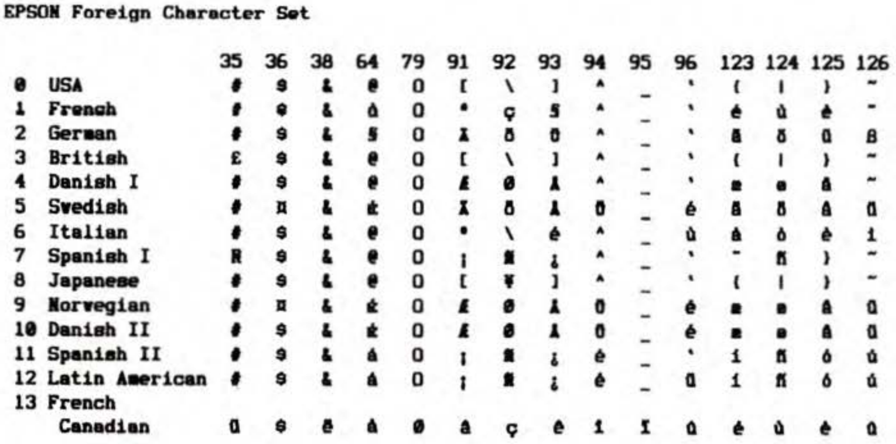
Select international character set E
ESC R n
27 82 n
n=0 to 13

Select international character set P
ESC ! n
27 33 n
n=64 to 75

These commands allow you to select character sets that replace some less-frequently used characters with symbols used in a variety of European languages.

To access these character sets, replace n with a value taken from the appropriate International Character Sets table.

Epson International Character Sets



EPSON Foreign Character Set

		35	36	38	64	79	91	92	93	94	95	96	123	124	125	126
0	USA	#	$	&	@	O	[	\	]	^	_	`	{	|	}	~
1	French	#	$	&	à	O	°	ç	§	^	_	`	é	ù	è	¨
2	German	#	$	&	§	O	Ä	Ö	Ü	^	_	`	ä	ö	ü	ß
3	British	£	$	&	@	O	[	\	]	^	_	`	{	|	}	~
4	Danish I	#	$	&	@	O	Æ	Ø	Å	^	_	`	æ	ø	å	~
5	Swedish	#	¤	&	É	O	Ä	Ö	Å	Ü	_	é	ä	ö	å	ü
6	Italian	#	$	&	@	O	°	\	é	^	_	ù	à	ò	è	ì
7	Spanish I	R	$	&	@	O	¡	Ñ	¿	^	_	`	¨	ñ	}	~
8	Japanese	#	$	&	@	O	[	¥	]	^	_	`	{	|	}	~
9	Norwegian	#	¤	&	É	O	Æ	Ø	Å	Ü	_	é	æ	ø	å	ü
10	Danish II	#	$	&	É	O	Æ	Ø	Å	Ü	_	é	æ	ø	å	ü
11	Spanish II	#	$	&	á	O	¡	Ñ	¿	é	_	`	í	ñ	ó	ú
12	Latin American	#	$	&	á	O	¡	Ñ	¿	é	_	ü	í	ñ	ó	ú
13	French Canadian	û	$	ë	à	Ø	â	ç	ê	î	ï	ô	é	ù	è	û

IBM

The IBM emulations offer a choice of two American English character sets: one in which the numeral 0 is printed with a slash and one with an unslashed zero. The slashed zero is convenient if you're printing documents where it's important to distinguish between zero and the capital letter O.

IBM International Character Sets

IBM Foreign Character Set

	35	36	38	48	64	79	91	92	93	94	95	96	123	124	125	126
64 USA - Ø	#	$	&	Ø	@	O	[	\	]	^	_	`	{	|	}	~
65 USA - 0	#	$	&	0	@	O	[	\	]	^	_	`	{	|	}	~
66 British	£	$	&	0	@	O	[	\	]	^	_	`	{	|	}	~
67 German	#	$	&	0	§	O	Ä	Ö	Ü	^	_	`	ä	ö	ü	ß
68 French	£	$	&	0	à	O	°	ç	§	^	_	`	é	ù	è	ê
69 Swedish	§	¤	&	0	É	O	Ä	Ö	Å	^	_	é	ä	ö	å	ü
70 Danish	#	$	&	0	@	O	Æ	Ø	Å	Ü	_	`	æ	ø	å	ü
71 Norwegian	#	$	&	0	@	O	Æ	Ø	Å	^	_	`	æ	ø	å	~
72 Dutch	£	$	&	0	@	O	[	Ĳ	]	^	_	`	{	ĳ	}	~
73 Italian	£	$	&	0	§	O	°	ç	é	^	_	ù	à	ò	è	ì
74 French Canadian	û	$	ê	0	à	Ø	â	ç	ê	î	Ï	ô	é	ù	è	û
75 Spanish	¡	$	&	0	¡	O	Ñ	ñ	¿	ü	_	á	é	í	ó	ú

Select italics/graphics characters E
ESC t n
27 116 n
n=1: Graphics
n=0: Italics

Epson

In the Epson emulation, you can specify the set of characters to occupy decimal values 160 to 255, either italic characters or a set of special symbols and graphics characters. Refer to Appendix C for the tables of these characters. You will notice that with either of these sets selected, the characters from decimal 128 to 159 are either control codes or are unused.

Select IBM Character Set I P
ESC 7
27 55

Select IBM Character Set II P
ESC 6
27 54

IBM

Both of these character sets contain special symbols and graphics characters in addition to the standard alphanumerics. The difference is that in Set II, decimal values 3 to 6, 21, and 128 to 159 represent printable characters, while in Set I, these positions are either occupied by control codes or are unused. Refer to Appendix C for the tables of these characters.

Select All Characters Set P
    ESC \ n1 n2
    27 92 n1 n2
    n1,n2=0 to 255

Print one character in All Characters Set P
    ESC ^
    27 94

IBM

The All Characters Set, shown in Appendix C, contains only printable characters, with the exception of decimal codes 0 and 255. Besides giving you a broad range of graphics characters and other special symbols, the All Characters Set is a handy debugging tool for programmers, since you can print out and examine files that contain control codes and escape sequences.

If you just want to print a single character from this set, use the ESC ^ command. The next character printed will be taken from the All Characters Set.

Printing continuously from the All Characters Set is a little more complicated, because you have to specify how many characters you intend to print. If you are printing fewer than 256 characters, substitute the number of characters for the variable n1, and replace n2 with 0. To print 256 or more characters, divide the number of characters you want to print by 256. Replace n2 with the whole number result, and assign the remainder to n1.

When you send this command, the next n1+(n2×256) characters will come from the All Characters Set.

Examples

To print the next 80 characters from the All Characters Set, use this BASIC statement:

```
LPRINT CHR$(27);" \";CHR$(80);CHR$(0)
```

To print the next 600 characters from the All Characters Set, use this BASIC statement:

```
LPRINT CHR$(27);" \";CHR$(88) ; CHR$(2)
```

(600 divided by 256 is 2, with a remainder of 88.)

Print control codes as characters ESC I n 27 73 n n= 1: Control codes printed as characters n= 0: Control codes function normally	E
Turn on control code character printing ESC 6 27 54	E
Turn off control code character printing ESC 7 27 55	E

Epson

In the Epson emulation, the ASCII characters 0 to 31 and 128 to 159 are normally interpreted as control codes and cannot be printed. In some cases, however, you may wish to store custom characters in these locations. The ESC I command turns control code printing on or off for both locations. ESC 6 and ESC 7 turn control code printing on or off only for locations 128 to 159. By using these commands, you can print custom characters stored in these areas.

Margins

Set left margin E
ESC l n
27 108 n
n=0 to 254

Set right margin E
ESC Q n
27 81 n
n=1 to 255

Set left and right margins P
ESC X n1 n2
27 88 n1 n2
n1: Left margin
n2: Right margin
n1=0 to 254
n2=1 to 255

In both the Epson and IBM margin commands, you set margins by character columns. The actual position of the margin depends on the current pitch: a margin of 10 columns will come out as one inch in 10 cpi and one-half inch in 20 cpi. If the current pitch is proportional, the margin is set as though it were 10 cpi. However, once you've set a margin, its absolute position remains the same, even if you change pitch, until you specifically reset the margin. This saves you the work of adjusting margins with every pitch change in your document.

You should always send margin commands at the beginning of a line.

Be sure to specify a right margin that is at least one more than the left margin.

Epson

Sending the left margin command will cancel any horizontal tab stops you may have set, returning the printer to its default of tab stops every eight columns.

Range of Margin Settings
(Epson Emulation)

	ML 320		ML 321	
Pitch	Left	Right	Left	Right
10 cpi/proportional	0-79	1-80	0-135	1-136
12 cpi	0-95	1-96	0-162	1-163
17.1 cpi	0-136	1-137	0-232	1-233
20 cpi	0-159	1-160	0-254	1-255

IBM

If you just want to change one of the margins, give a value of 0 for the margin you don't want to change. The default left margin for the IBM emulation is 1; for default right margins, see the table below.

Default Right Margin Settings
(IBM Emulation)

Pitch	ML320	ML321
10 cpi/proportional	80	136
12 cpi	96	163
17.1 cpi	137	233

Justification E

ESC a n
27 97 n
n=0: Left
n=1: Center
n=2: Right
n=3: Full (left and right)

Epson

This command lets you specify the alignment of text on the page: along the left or right margin, centered between the margins, or along both the left and right margins. When you are using center, right or full justification, the backspace character (ASCII BS, decimal 8) and horizontal tabs won't function. If you're using full justification, use a carriage return only at the end of a paragraph, not at the end of each line.

Tabs

Horizontal tab E P
    HT
    9

Set horizontal tab stops E P
    ESC D n1...nk NUL
    27 68 n1...nk 0
    Epson:
    n=1 to 255
    k=1 to 32
    IBM:
    n=1 to 65
    k=1 to 28

When you turn on your printer, its tab stops are automatically set for every eight columns. Each time you send a tab character (ASCII HT, decimal 9), the printhead moves 8 columns to the right before printing the next character.

In both emulations, you can use the ESC D command to set horizontal tab stops at specific columns on the page. As with margins, the actual position of the stops depends on the pitch you're using, and won't change if you switch to a different character width. Be sure to give the stops in ascending order, and after you have specified all the stops, end the sequence with a NUL character (use CHR$(0) in BASIC).

If you send the command as ESC D NUL, with no stops specified, all horizontal tab stops will be cleared, including the 8-column default stops. Turning the printer off and on again restores the printer's default tab stops of every eight columns.

Epson

You can set up to 32 tab stops in the Epson emulation.

Setting a new left margin or sending the Reset command (ESC @) will also restore the default tab stops.

Maximum Values for Horizontal Tab Stops

Pitch	ML 320	ML 321
10 cpi/proportional	79	135
12 cpi	95	162
17.1 cpi	136	232
20 cpi	159	255

IBM

You can set up to 28 stops in the IBM emulation.

ESC R resets tab stops to the default. (See page 43.)

Vertical tab E P
VT
11

Set vertical tab stops E P
ESC B n1...nk NUL
27 66 n1...nk 0
Epson:
k=1 to 16
n=0 to 255
IBM:
k=1 to 64
n=0 to 65

When you turn the power on, your printer doesn't have any vertical tab stops. Sending a VT command with no stops set results in a single line feed.

You can use the ESC B command to set a series of vertical tab stops. Once you've set the stops, each time you issue a VT command the paper will move up to the next stop position.

You must enter the stops in ascending order, ending the series with a NUL character. ESC B NUL will delete all vertical tab stops.

The actual position of the stops depends on the line spacing in effect when you send the ESC B command. For example, at 6 lines per inch, a tab stop of 24 will appear four inches from the top of the page, whereas at 8 lines per inch, the stop will be positioned three inches from the top of the page. However, once you've set the vertical tab stops, their position is absolute, and won't move, even if you later change the line spacing.

Epson

The Epson emulation allows up to 16 stops.

IBM

The IBM emulation gives you as many as 64 stops.

Select vertical tab channel E
ESC / n
27 47 n
n=0 to 7

Set vertical tabs for channel n E
ESC b n m1...mk NUL
27 98 n m1...mk 0
n=0 to 7
m=0 to 255
k=1 to 16

Epson

The Epson emulation also gives you the option of setting up to eight separate sets—called channels—of vertical tab stops. The command to set vertical tab channels, ESC b, uses the same principles as ESC B (page 41): stops are listed in ascending order, and the list ends with NUL. However, you also have to specify which channel you're setting stops for by giving a value from 0 to 7 for the variable n. Once you've set up the stops in the channels you're using, you perform the vertical tabs by sending the ESC / command to specify a channel, followed by VT.

Example

The following BASIC program sets stops in three channels, and then performs a series of vertical tabs in the different channels:

```
  5 REM Stops in channel 0: lines 10, 20, 30, 40, 50
 10 LPRINT CHR$(27);″b″;CHR$(0);CHR$(10);CHR$(20);CHR$(30);
    CHR$(40);CHR$(50-);CHR$(0)
 20 REM Stops in channel 1: lines 5, 15, 35, 45, 55
 30 LPRINT CHR$(27);″b″;CHR$(1);CHR$(5);CHR$(15);CHR$(35);
    CHR$(45);CHR$(55);CHR$(0)
 40 REM Stops in channel 2: lines 12, 24, 48
 50 LPRINT CHR$(27);″b″;CHR$(2);CHR$(12);CHR$(24);
    CHR$(48);CHR$(0)
 60 LPRINT CHR$(27);″/″;CHR$(1): REM Select channel 1
 70 LPRINT CHR$(11);″This prints on line 5″
 80 LPRINT CHR$(11);:LPRINT CHR$(11);″This prints on line 35″
 90 LPRINT CHR$(27);″/″;CHR$(2): REM Select channel 2
100 LPRINT CHR$(11);″This prints on line 48″
110 LPRINT CHR$(27);″/″;CHR$(0): REM Select channel 0
120 LPRINT CHR$(11);″This prints on line 50″
```

Reset horizontal and vertical tabs to default   P

ESC R
27 82

IBM

Use this command to cancel any tab stops you have set and return to the printer's defaults. This means that horizontal tab stops will occur every eight columns, and that there will be no vertical stops—a VT command will just produce a single line feed.

Horizontal dot position

Absolute horizontal dot position E
ESC $ n1 n2
27 36 n1 n2
n1=0 to 255
n2=0 to 3

Indent from left margin P
ESC % B n1 n2 n3 n4
27 37 66 n1 n2 n3 n4
1B 25 42 n1 n2 n3 n4
n1,n2,n3,n4= 48 to 57

Relative horizontal dot position E
ESC \ n1 n2
27 92 n1 n2
n1=0 to 255
n2=0 to 3

These commands let you place text or graphics very precisely on the page. (For precise vertical positioning, see the description of the fine line feed and line spacing commands on pages 45 and 46.)

Epson

In the Epson commands, determine the values of the two variables by dividing the desired dot position by 256; assign the whole number result to n2 and the remainder to n1.

The ESC $ command uses the left margin as a reference point, and moves the print position in $\frac{1}{60}''$ increments.

The ESC \ command lets you move the print position to either the right or the left of the current print position. Overscore characters don't print in the space between the two positions.

First determine the distance you want to move. Movement is measured in dots, and the number of dots per inch depends on the current print mode. Use the Horizontal Position Units table to calculate the number of dots you want to move.

Horizontal Position Units

Print quality	Dots per inch	Dots per line ML 320	 ML 321
High speed draft	100	800	1360
Utility	120	960	1632
NLQ	240	1920	3262

If you want to move to the right, use the method described above to calculate n1 and n2. If you're moving to the left of the current print position, subtract the number of dots from 65536, then calculate the values of n1 and n2 as described above.

IBM

The IBM ESC % command operates just like the Epson ESC $ command, but the distance to be moved is represented differently. The variables n1 to n4 correspond to ASCII numerals. Together, they make up a 4-place ASCII number that directly specifies movement from the left in 1/60″ increments.

Line feed

Line feed E P
LF
10

Fine line feed E P
ESC J n
27 74 n
n=0 to 255
Line feed is n/216″

Reverse n/216″ line feed E
ESC j n
27 106 n
n=0 to 60

Reverse line feed P
ESC]
27 93

The line feed command (ASCII LF, decimal 10) makes the printer print a line and then moves the print position down one line on the page. If Auto CR is ON in the menu, this line feed also results in a carriage return, which puts the print position at the left margin. The amount of vertical movement depends on the current line spacing. (See "Line Spacing," page below for details.) This command also cancels one-line double width printing.

Unlike the simple LF code, the fine line feed command is not accompanied by a carriage return, and does not cancel one-line double width printing. If you substitute 0 for n, no line feed will be performed.

The fine line feed command is ideal for printing graphics, since it gives you precise control over the vertical placement of dots in an image.

Use the reverse line feed command to move the paper up one line in the IBM emulation, and in $^{1}/_{180}''$ increments in the Epson emulation. The paper will not advance beyond the top of form position.

Line spacing

Begin $^{1}/_{8}''$ line spacing E P
ESC 0
27 48

Begin $^{7}/_{72}''$ line spacing E P
ESC 1
27 49

Begin $^{1}/_{6}''$ line spacing E
ESC 2
27 50

Set variable (n/72″) line spacing E P
ESC A n
27 65 n
Epson: n=0 to 85
IBM: n=0 to 255

Begin variable line spacing P
ESC 2
27 50

Begin fine line spacing E P
ESC 3 n
27 51 n
1B 33 n
n=0 to 255
Spacing is n/216″

The most common spacings for text are 6 and 8 lines per inch (lpi). A spacing of 8 lpi works well with compressed character pitches, and lets you fit more lines on a page.

Several of these commands let you control vertical movement in very fine units, which helps with the precise placement of graphics. (See also ESC 1 in the IBM emulation below.)

Epson

The ESC A command both sets and begins n/72″ line spacing.

IBM

You must use the ESC A and ESC 2 commands together. ESC A specifies line spacing of n/72″, and then the ESC 2 command tells the printer to begin using the new line spacing. (The other commands both specify and begin spacing.) If you send an ESC 2 command without first using ESC A, the printer will reset the line spacing to the current menu setting.

Forms control

Form feed FF 12	E P
Set form length by inches ESC C NUL n 27 67 0 n Epson: n=1 to 22 IBM: n=0 to 255	E P
Set form length by lines ESC C n 27 67 n Epson: n=1 to 127 IBM: n=0 to 255	E P

When you send a form feed command, the printer prints any data that is in its buffer, and the print position moves to the top of the next page. You can also use the FORM FEED button on the control panel to feed a page through the printer.

You can specify a form length in either inches or lines. If you will most often be using one of the standard page lengths listed on the menu, we recommend using Menu Select mode to set a default form length, and then using one of the form length commands whenever you want to change it temporarily.

When you use ESC C or ESC C NUL to change the form length, the skip over perforation setting returns to the menu default (0), and top-of-form is set at the current print position.

Skip over perforation — E P

ESC N n
27 78 n
Epson: n=1 to 127
IBM: n=0 to 255

Reset skip over perforation to default — E P

ESC O
27 79

If skip over perforation is set to Yes on the menu, the printer will automatically skip an inch from the bottom of one page to the top of the next form. Use the ESC N command to change the number of lines skipped. The actual amount of space skipped between pages varies with the current line spacing; however, after you've set the skip size, it won't increase or decrease if you change line spacing. The ESC O command returns the perforation skip to its default.

Important

The skip over perforation feature will interfere with page formatting controlled by software packages such as word processors. If you're using a package that controls page length directly, you should set the Skip Over Perforation item in the menu to OFF.

Set top of form — P

ESC 4
27 52

IBM

When you send this command, a new top of form is set at the current position of the printhead. In both emulations, you can also set a new top of form by using the front panel.

Miscellaneous

Carriage return E P
CR
13

When it receives this command, the printer will print data from the print buffer and return the printing position to the beginning of the line. If Auto Line Feed is ON in the menu, the printer adds a line feed to each carriage return. This command cancels one-line double width printing.

Backspace E P
BS
8

The backspace command prints any data that's in the print buffer and moves the printhead one character to the left. The actual width of the backspace depends on the current pitch. If you're using proportional spacing, the BS command moves the printhead one character width to the left as defined by the last character printed.

Reset E
ESC @
27 64

Epson

This command removes any data in the printer's buffer and returns the printer to the current menu settings. It will override any features set on the printer's front panel or through previous commands. This is also called initialization.

Many software packages send the reset command to initialize the printer before or after printing. This is done to make sure that settings from a previous print job don't accidentally carry over into the next one. However, this could interfere with settings you have made on the control panel or through control codes.

If your software lets you add or modify initialization strings (also called setup strings), you can eliminate reset commands you don't want, or add them where you want to be sure the printer is set to its defaults (the menu settings). Check your software manual for details on modifying initialization strings.

Clear buffer	E P

CAN
24

This command clears all the data from the print buffer, but does not reset printing features that have been set using control codes.

Delete one character	E

DEL
127

Epson

This command deletes the last character sent to the printer. It will not delete graphics data.

Automatic line feed	P

ESC 5 n
27 53 n
n=1: Activate auto line feed
n=0: Deactivate auto line feed

IBM

When you activate automatic line feed, the printer will add a line feed (page 45) to each carriage return code it receives. You can also control this feature through the menu.

Unidirectional printing E P
    ESC U n
    27 85 n
    n=1: Begin unidirectional printing
    n=0: Begin bidirectional printing

Your printer is designed to maximize speed by printing alternately from the left and right (bidirectional printing), rather than moving the printhead back to the left margin so that each line prints from left to right (unidirectional printing). Use unidirectional printing when precise vertical alignment from line to line is critical.

You can also select unidirectional graphics printing in Menu Select mode.

One line unidirectional printing E
    ESC <
    27 60

Epson

This command activates unidirectional printing for one line only.

Printing speed E
ESC s n
27 115 n
n=1: Begin half speed printing
n=0: Begin full speed printing

Epson

Use this command to control the speed of printing. Half speed printing is quieter than full speed.

Set 8th data bit to 1 E
ESC >
27 62

Set 8th data bit to 0 E
ESC =
27 61

Accept data as is E
ESC #
27 35

Epson

The ESC > command sets the most significant bit (MSB) of an 8-bit data input to 1. The ESC = command sets the MSB to 0. ESC # cancels MSB control established by either ESC > or ESC = and all data is interpreted exactly as sent from the computer.

Begin print suppress mode E
DC3
19

Begin print suppress mode P
ESC Q n
27 81 n
n=3 (ML320), 22 (ML321)

End print suppress mode E P
DC1
17

When the printer receives the command to begin Print Suppress mode, it ignores all data until it receives the DC1 code. This means that any data will be lost. The SEL light blinks when the printer is in the Print Suppress mode.

Turn on paper-out sensor E P
ESC 9
27 57

Turn off paper-out sensor E P
ESC 8
27 56

The paper-out sensor detects when less than one inch of paper remains. When this happens, the alarm light goes on and the printer is deselected. This command overrides the sensor so that you can print closer to the bottom of the page. (The feature is also menu selectable.) Be careful if you use this feature, since it lets the printer continue printing when there's no more paper. This can cause loss of data and may damage the printhead. You can also override the detector manually by presssing the SEL button, which prints one line followed by a line feed.

Cut Sheet Feeder Control

Note The following commands are active only when the optional Cut Sheet Feeder 3000 is installed on the printer.

Insert Page ESC EM I 27 25 73	E P

This command feeds a sheet of paper from the CSF 3000 to the top of form position. If paper is already in the printer, the printer will eject the page and load another.

Eject Page ESC EM R 27 25 82	E P

This command prints data in the print buffer and ejects the page. A line feed code (page 45) at the end of the page causes the next page to feed into the printer automatically.

▶ Chapter 4: Graphics and Custom Characters

Overview

One of the strengths of dot matrix printer technology is the flexibility that comes from printing patterns of dots. If you can control where dots are printed, you can print almost any kind of graphic image. (If you look closely at a photo in a newspaper, you'll notice that it's made up of thousands of tiny dots.) You can also change the shape of the printed characters to create special symbols used in some scientific fields or whole new character sets for printing in languages like Hebrew and Russian. You can harness this power by using your ML320/321's bit image graphics and custom character (also called downloaded character) features.

Programming these features yourself is a complex and tedious process—the simplest graphic image can contain several hundred dots, and designing a legible character may involve a lot of trial and error as well as considerable programming effort. Fortunately, there are many good graphics and font packages that support the printers your ML320/321 emulates, and we strongly recommend that you consider using one. These packages are sophisticated programs designed to handle all those dots for you, so that you can create images and special characters easily without writing a single line of programming.

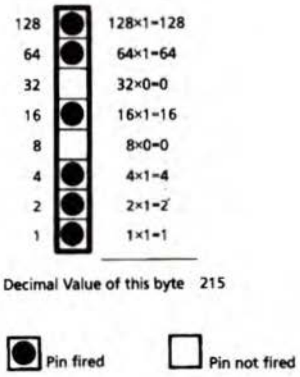
But if you really want to, you can write your own programs to produce graphics printouts and custom characters. First you should know a little about how your printer works.

Your MICROLINE 320 or 321 printhead has one column of 9 pins. Images are created as the pins "fire," striking the ribbon against the paper to produce dots. White spaces appear where the pins don't fire.

Whether you're programming a graphic image or designing custom (also called downline loadable—DLL) characters to download to the printer, your program has to describe the pattern of dots that you want to print. Graphics and custom character data, like all other data sent to the printer, consist of a series of bytes. Each of the eight bits in a byte of graphics or character data corresponds to one pin on the printhead. A bit's value can be either 1 or 0. When the printer receives the data, it interprets a bit with a value of 1 as a command to fire the corresponding pin. Bits that are set to 0 don't cause pins to fire.

You can picture the byte as a column of 8 bits. In 8-pin graphics, the body of data is a series of these columns lined up next to each other.

Instead of sending the data to the printer bit by bit, you'll probably want to convert this binary information into decimal or hexadecimal format for use with your programming language. In the figure below we show how to determine the decimal value for a given pattern of pins.



Now that you understand the basic principles, we'll go into the details of how to put the information together to form a complete image or character and how to send that information to the printer.

Graphics

The MICROLINE 320/321's 9-pin printhead can produce either 8-pin or 9-pin graphics. Most software uses the 8-pin mode, in which each column of dots is represented by a single byte of data. The 9-pin mode is used in cases where a slightly higher resolution is required. It uses two bytes to represent each dot column.

Programming graphics in BASIC

One important thing to remember when you're programming graphics is not to include extraneous line feeds in your programs. Using a semicolon after the data in an LPRINT statement will keep the print position on the same line.

However, there is an additional complication: by default, BASIC assigns to all printers a maximum line length of 80 characters. After the printer has received 80 bytes of data, it will automatically perform a carriage return and line feed. Since graphics data typically consists of many bytes, it's quite easy to exceed this limit. The resulting output will be garbled. You can work around this problem by setting the line length to the maximum allowable value, 255. Put one of these statements at the beginning of your program:

- For parallel printers:

```
WIDTH "LPT1:",255
```

- For serial printers that have been opened as #1:

```
WIDTH #1,255
```

8-pin Graphics

Begin 8-pin graphics E

ESC * m n1 n2 [graphics data]
27 42 m n1 n2 [graphics data]
n1,n2=0 to 255
m=0 to 7

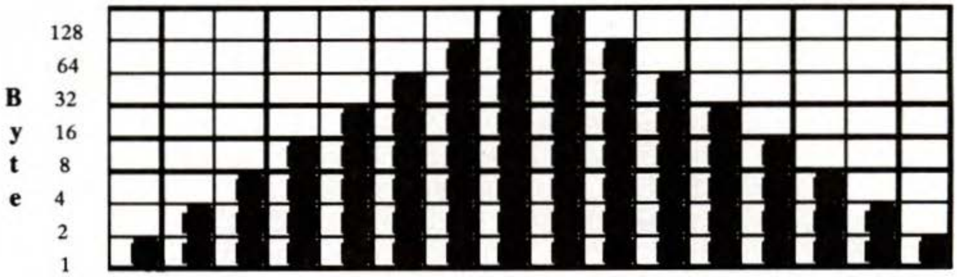
Epson

This command provides access to most 8-pin graphic features under the Epson emulation. The variable m is used to specify the density of the graphic image. For our example, we'll print in 8-pin quadruple density, so we'll assign to m a value of 3. The following table shows the codes to be used in selecting graphics print densities.

8-pin Graphics Density Codes (Epson Only)

Graphics type	Horiz. density (Dots per inch)	Value of m
Single density (8-pin)	60	0
Double density (8-pin)	120	1
High speed double density (8-pin)	120	2
Quadruple density (8-pin)	240	3
CRT I (8-pin)	80	4
Plotter	72	5
CRT II	90	6
Double density plotter	144	7

Once you've selected the density you want to use, you have to design your graphic image. Begin by mapping out the pattern you want to print on a piece of graph paper. We're using a triangle.



The variables n1 and n2 tell the printer how many columns of data you'll be sending; 8-pin modes have one byte of data per column. To calculate the values for these variables, first determine how many columns of dots there will be in your graphics image. Divide this number by 256 and assign the whole number result to n2; assign the remainder to n1. In our triangle example, each triangle requires 16 columns. We will be printing a row of 6 triangles, however, so the total number of columns in the image is 96 (6×16). Dividing 96 by 256 gives a value of 0 for n2 with a remainder of 96, which we'll assign to n1.

Now that we've selected our density and decided how wide the image will be, we can write a BASIC statement that sends the command to begin 8-pin graphics:

```
LPRINT CHR$(27);"*";CHR$(3);CHR$(96);CHR$(0);
```

Note

Be sure to include the semicolon (;) at the end of this statement. That way, the printer won't insert a carriage return and line feed before your graphics data.

The listing below is the BASIC program for the Epson emulation that generates a row of six triangles in quadruple density. To print the pattern at another density, change the value of D in line 10 to one of the other density codes.

Note

When you are typing in the program, you don't have to include lines beginning with REM or the comments that appear after an apostrophe (') in a program line. You can also combine the DATA statements into longer lines; we've separated them into groups of three bytes so you can tell where each column begins and ends.

```
 10 D=3 ‘Density code for quadruple density (Epson)
 20 WIDTH ″LPT1:″,255 ‘Set printer for maximum line width
 30 LPRINT CHR$(27);″*″;CHR$(D);CHR$(96);CHR$(0);
 40 REM CHR$(D) is the density; in this case D=3 for quadruple
    density
 50 REM CHR$(96) and CHR$(0) indicate the number of columns
 60 FOR I=1 TO 6 ‘Repeat triangle pattern six times
 70 FOR J=1 TO 16 ‘Each triangle has 16 columns
 80 READ A ‘Read the column
 90 LPRINT CHR$(A); ‘Send the byte to the printer
100 NEXT J ‘Now print the next column
110 RESTORE ‘Go back to the beginning of the DATA statements
120 NEXT I ‘Now print the next triangle
130 END
140 DATA 1,3,7,15,31,63,127,255,255,127,63,31,15,7,3,1
```

Your printout will look like this:

Print registration

The PRINT REGISTRATION Menu Select item is a bit image graphics option that is only used with bidirectional printing. It lets you fine-tune the column alignment of a graphic image or table where precise column alignment is important. You'll probably need to experiment with the different settings to find which works best for your printouts. One way to determine the best value is by printing several lines of vertical bar characters (|) at each registration value. Use the setting that produces the straightest vertical column.

Print Registration Settings

Setting	Resulting movement
+5	0.25 mm to the right
+4	0.20 mm to the right
+3	0.15 mm to the right
+2	0.10 mm to the right
+1	0.05 mm to the right
0	no movement
-1	0.05 mm to the left
-2	0.10 mm to the left
-3	0.15 mm to the left
-4	0.20 mm to the left
-5	0.25 mm to the left

Begin single density graphics E P
ESC K n1 n2 [graphics data]
27 75 n1 n2 [graphics data]
n1,n2=0 to 255

Begin double density graphics E P
ESC L n1 n2 [graphics data]
27 76 n1 n2 [graphics data]
n1,n2=0 to 255

Begin high speed single density graphics E P
ESC Y n1 n2 [graphics data]
27 89 n1 n2 [graphics data]
n1,n2=0 to 255

Begin quadruple density graphics E P
ESC Z n1 n2 [graphics data]
27 90 n1 n2 [graphics data]
n1,n2=0 to 255

These graphics modes correspond to the 8-pin modes. They are available in both emulations and are supported by most current DOS-based graphics software.

The variables n1 and n2 tell the printer how many bytes of graphics data to expect. Remember, the 8-pin modes have one byte of data per column. To calculate the values for these variables, first determine how many columns of dots there will be in your graphics image. Divide this number by 256 and assign the whole number result to n2; assign the remainder to n1.

Reassign graphics codes E
ESC ? n m
27 63 n m
n="K" "L" "Y" or "Z"
m=0 to 7

Epson

In the Epson emulation, you can reassign any of the 8-pin graphics modes to one of the graphics commands (ESC K, ESC L, ESC Y or ESC Z). For n, substitute one of the four letters (K, L, Y or Z, decimal 75, 76, 89 or 90) to indicate which of the four commands you're redefining. The variable m stands for the density code of the mode that you are reassigning to the redefined code. (See the 8-pin Graphics Density Codes table on page 60.) Then, when you are ready to print a graphics pattern, send the redefined command, followed by the graphics data.

Example

The following BASIC statement reassigns quadruple density to the command ESC L.

```
LPRINT CHR$(27);"?";"L";CHR$(3)
```

9-pin graphics

Begin 9-pin graphics E
ESC \ m n1 n2 [graphics data]
27 94 m n1 n2 [graphics data]
n1=0 to 255
n2=0 to 7
m=0: Single density
m=1: Double density

Epson

This command permits use of all nine pins on the 320/321 printhead. It operates exactly like the ESC * command, except that dot columns are given two bytes each instead of one. The first byte for each column represents the top eight pins, just like the ESC * command. The second byte is 128 if the bottom (9th) pin is to be fired, and zero if not.

Custom Characters

Your printer's custom (downline loadable) character feature enables you to design your own characters and symbols, even entire character sets if you choose, and download them from your computer to the printer. You can design and store up to 256 characters. Your custom characters are assigned to keys of your choice on your keyboard. Then, whenever you need a particular character, all you have to do is invoke the custom character set and press the key assigned to your character. The actual designing of these characters requires some work on your part and can become tedious. Once again, we strongly recommend using a commercial software package to help you create new characters and download them to your printer. There are also packages that provide character sets that have already been designed for you.

Epson Custom Characters

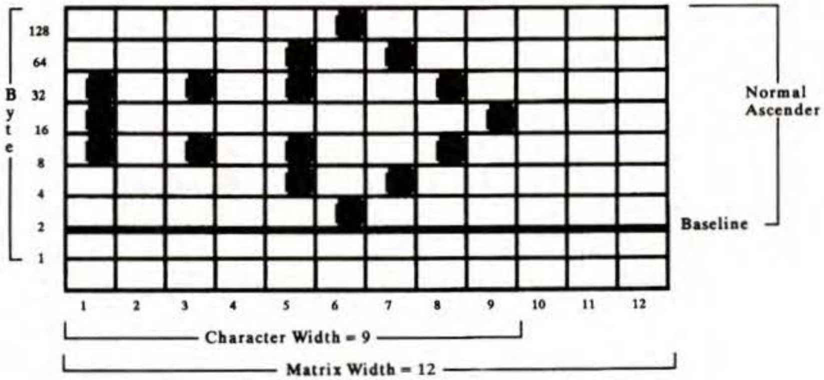
The technique of designing your own custom characters is much like that of designing a graphic image, but on a much smaller scale. You can design characters in either Utility or NLQ mode: simply activate the desired mode before you download the characters.

Begin by designing your character on a grid. The height of the grid for a normal character is 7 dots (though 8 dots can be used), each corresponding to a pin on the printer's printhead. The width of the grid is 11 dots (depending on print mode).

The 7-dot grid can be adjusted up or down several dot positions by using the attribute byte in the print command. This byte specifies whether the character is an ascender (top 7 rows) or a descender (bottom 7 rows). The attribute byte also contains other information about the character, as explained later.

The character's baseline occurs below the seventh dot from the top if it is an ascender, or below the sixth dot from the top if it is a descender. The columns of the matrix to the left and right of your character affect where it will appear in relation to the characters on either side of it. There is one mandatory blank column at the end of the character (column 12). If you don't leave blank columns, adjacent characters may appear to run right into your character.

Your arrangement of dots is translated into code that tells your printer the exact location of each dot within each column. The example below illustrates how this works.



Our character is 9 dots wide and is flush to the left. We'll print it in 10 cpi Utility. Just like 8-pin graphics, each byte specifies a dot column, and the value of each byte is determined by adding up the values of its bits.

Note In all print modes, you cannot place two dots next to each other horizontally—you must skip one column.

Now we need to give the commands that download this data to the printer.

Epson Custom Characters

Copy ROM characters to RAM E
ESC : NUL NUL NUL
27 58 0 0 0

Download custom characters E
ESC & NUL n1 n2 d [character data]
27 38 0 n1 n2 d [character data]

Select custom character set E
ESC % n
27 37 n
n=1: Select custom character set
n=0: Select standard character set

First, we have used the ESC : NUL NUL NUL command to copy a complete set of the characters resident in the printer to the area of its memory reserved for custom characters. The new character will become part of this character set.

To begin downloading our character, we'll use the ESC & command. The variables n1 and n2 specify the range of characters that we'll be replacing with new ones. If you're going to download several characters, they must be assigned to adjacent locations. The first variable, n1, indicates the first character that will be replaced, and n2 indicates the last. Custom characters can normally be assigned to decimal locations 32 to 127 and 160 to 255. If IBM Character Set II is selected (the ESC 6 command), then characters can also be assigned to locations 128 to

159. If Epson mode control code printing is selected (ESC I), then all locations from 0 to 255 are available.

As a final step before sending the character data to the printer, we'll indicate how we've positioned the character within its grid using the variable d as follows:

d = last dot column of character
+ first dot column × 16
+ attribute (128 = ascender, 0 = descender)

See the illustration of our sample character on page 66.

Follow these variables with the data for the character calculated from your grid. If you're downloading several characters, you only need one ESC & NUL command, and you only need to include n1 and n2 once, but you must include a value for d in each set of character data.

Use the ESC % command to switch between the standard character set and the custom character set. The custom character set will stay in the printer's memory until:

- you turn the printer off
- you reset the printer with the ESC @ command
- you overwrite them with new custom characters
- you use the ESC : NUL NUL NUL command to overwrite them with the standard character set.

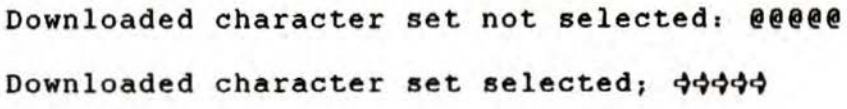
Example

The following listing loads the standard character set into the custom character memory, downloads our sample arrow character into the location of the character "@" and prints it.

When you are typing in the program, you don't have to include lines beginning with REM or the comments that appear after an apostrophe (') in a program line. You can also combine the DATA statements into longer lines; we've separated them into groups of three bytes so you can tell where each column begins and ends.

```
 10 WIDTH "LPT1:",255 'Prepare printer
 20 LPRINT CHR$(27);"@" 'Reset (initialize) printer
 30 LPRINT CHR$(27);"x0";'Turn on UTILITY print mode
 40 LPRINT CHR$(27);":";CHR$(0);CHR$(0);CHR$(0);'Copy ROM
    characters into RAM
 50 LPRINT CHR$(27);"&";CHR$(0);'Start character definition
 60 LPRINT "@@";
 70 REM Range of characters to be defined in this case only 1
    character
 80 REM ASCII @, decimal 64
 90 LPRINT CHR$(153); 'Placement of character in matrix
100 FOR I=1 TO 11 'Character contains 11 columns of dots
110 READ A 'Read the column
120 LPRINT CHR$(A); 'Send byte to the printer
130 NEXT I 'Next column
140 REM Begin character data
150 DATA 0,56,0,40,0,108,130,68,40,16,0
160 REM End of character data
170 LPRINT "Downloaded character set not selected: @@@@@"
180 LPRINT CHR$(27);"%";CHR$(1) 'Select downloaded
    character set
190 LPRINT "Downloaded character set selected; " ;
200 LPRINT CHR$(27);"E";'Turn on emphasized see NOTE below
210 LPRINT "@@@@@"
220 LPRINT CHR$(27);"%";CHR$(0) 'Deselect downloaded
    character set
230 LPRINT CHR$(27);"F" 'Turn off emphasized
240 END
```

Your printout will look like this:



```
Downloaded character set not selected: @@@@@

Downloaded character set selected; ◆◆◆◆◆
```

Note

We turned on emphasized printing before using the downloaded character to compensate for the constraint against having two dots next to each other horizontally in a custom character. Emphasized printing is accomplished by offsetting dots horizontally, so it fills in the gaps somewhat.

IBM Custom Characters

Copy ROM characters to RAM P
ESC $
27 36

Download custom character P
ESC = c1 c2 m n [character data]
27 61 c1 c2 m n [character data]
c1,c2,n=0 to 255
m= 20 or 21

IBM custom characters are created and used much like Epson custom characters, but there are several important differences. In the following example, we will use the same 7 x 11 cell arrow character used previously.

As before, the printer's character set is first copied to memory—in this case, using the ESC $ command. Then, to begin downloading the new character, the ESC = command is used. The variables c1 and c2 define the total number of columns to be downloaded. This can be determined by multiplying the number of characters you are going to change by 13, then adding 2. The value of c2 is then simply the number of times 256 can be divided into that total, and c1 is the remainder.

The variable m selects either utility (20) or NLQ (21) print quality, and n specifies the starting character in the set to be redefined (characters must be redefined in sequence). In the following discussion, we will focus only upon utility mode printing, since this is the easiest and most commonly used custom character mode.

Each character to be redefined requires two attribute characters, followed by the dot column data. The first attribute character defines whether the character is an ascender (0) or a descender (128). This determines whether the 7-row character will be printed from the top or shifted down. The second attribute character specifies how the character will fit in the 7 x 11 matrix. To determine this character, you must first find the following:

b1 = Width of printed character (dot columns)
b2 = Empty columns before the first printed dot column

The second attribute character can now be found as follows:
attribute character = (b1 × 2) + (b2 × 16)

The second attribute character is then followed by the same character data used in the Epson command.

To use the IBM character set, you must first select a DLL print mode with the ESC I command. For utility, this is mode 4. You can cancel custom character printing with the same command by simply selecting another mode. The custom character set can be cleared from memory by the command ESC = NUL NUL.

Example

```
 10 WIDTH "LPT1:",255 'Prepare printer
 20 LPRINT CHR$(27);"I";CHR$(0); 'Set printer for utility
    printing
 30 LPRINT CHR$(27);"$";'Copy ROM characters into RAM
 40 LPRINT CHR$(27);"=";CHR$(15);CHR$(0);CHR$(20);'Start
    character definition, utility mode
 50 LPRINT "@";
 60 REM Start of characters to be defined (in this case only 1
    character)
 70 REM ASCII @, decimal 64
 80 LPRINT CHR$(0);CHR$(18); 'Character is an ascender and the
    width is 9. 9 x 2 + 0 x 16 = 18
 90 FOR I=1 TO 11 'Character contains 11 columns of dots
100 READ A 'Read the column
110 LPRINT CHR$(A); 'Send byte to the printer
120 NEXT I 'Next column
130 REM Begin character data
140 DATA 0,56,0,40,0,108,130,68,40,16,0,
150 REM End of character data
160 LPRINT "Downloaded character set not selected: @@@@@"
170 LPRINT CHR$(27);"I";CHR$(4); 'Set printer for utility DLL
```

```
180 LPRINT "Downloaded character set selected; ";
190 LPRINT CHR$(27);"E";'Turn on emphasized
200 LPRINT "@@@@@"
210 LPRINT CHR$(27);"F";'Turn off emphasized
220 LPRINT CHR$(27);"I";CHR$(3); 'Set printer for NLQ Courier
230 END
```

▶ Appendix A: Control Codes

Control Code Index

This index is in two sections: the first is for Epson emulation codes, and the second is for the IBM Proprinter emulation. Each is complete and is arranged numerically, so you can quickly look up commands by ASCII codes. Use it as a reference for interpreting printer drivers, software initialization strings, etc. Page references are given to help you find more information on the commands

Epson Code Index

Epson code	Decimal	Hexadecimal	Function	Page
BS	8	08	Backspace	50
HT	9	09	Horizontal tab	40
LF	10	0A	Line feed	45
VT	11	0B	Vertical tab	41
FF	12	0C	Form feed	48
CR	13	0D	Carriage return	49
SO	14	0E	Begin one-line double width printing	25
SI	15	0F	Begin compressed printing	26
DC1	17	11	End print suppress mode	54
DC2	18	12	End compressed printing	26
DC3	19	13	Begin print suppress mode	54
DC4	20	14	End one-line double width printing	25
CAN	24	18	Clear buffer	51

Epson Code	Decimal	Hexadecimal	Function	Page
ESC SO	27 14	1B 0E	Begin one-line double width printing	25
ESC SI	27 15	1B 0F	Begin compressed printing	26
ESC EM I	27 25 73	1B 19 49	Insert page	55
ESC EM R	27 25 82	1B 19 52	Eject page	55
ESC SPACE n	27 32 n	1B 20 n	Set character spacing	33
ESC ! n	27 33 n	1B 21 n	Print mode combinations	30
ESC #	27 35	1B 23	Cancel 8th bit control	53
ESC $ n1 n2	27 36 n1 n2	1B 24 n1 n2	Absolute horizontal dot position	44
ESC % n	27 37 n	1B 25 n	Select custom character set	67
ESC & NUL n1 n2 d [character data]	27 38 0 n1 n2 d [character data]	1B 26 00 n1 n2 d [character data]	Download custom characters	67
ESC (n	27 40 n	1B 28 n	Select high speed draft	20
ESC * m n1 n2 [graphics data]	27 42 m n1 n2 [graphics data]	1B 2A m n1 n2 [graphics data]	Begin 8-pin bit-image graphics	59
ESC - n	27 45 n	1B 2D n	Underlining	29
ESC / n	27 47 n	1B 2F n	Select vertical tab channel	42
ESC 0	27 48	1B 30	Begin $1/8$ inch line spacing	46
ESC 1	27 49	1B 31	Begin $7/72$ inch line spacing	46
ESC 2	27 50	1B 32	Begin $1/6$ inch line spacing	46
ESC 3 n	27 51 n	1B 33 n	Begin fine line spacing	47
ESC 4	27 52	1B 34	Begin italics	22
ESC 5	27 53	1B 35	End italics	22
ESC 6	27 54	1B 36	Turn on control code character printing	37

Epson Code	**Decimal**	**Hexadecimal**	**Function**	**Page**
ESC 7	27 55	1B 37	Turn off control code character printing	37
ESC 8	27 56	1B 38	Turn off paper-out sensor	54
ESC 9	27 57	1B 39	Turn on paper-out sensor	54
ESC : NUL NUL NUL	27 58 0 0 0	1B 3A 00 00 00	Copy ROM characters to RAM	67
ESC <	27 60	1B 3C	One line unidirectional printing	52
ESC =	27 61	1B 3D	Set 8th data bit to 0	53
ESC >	27 62	1B 3E	Set 8th data bit to 1	53
ESC ? n m	27 63 n m	1B 3F n m	Reassign graphics codes	64
ESC @	27 64	1B 40	Reset	50
ESC A n	27 65 n	1B 41 n	Set variable (n/72 inch) line spacing	46
ESC B n1...nk NUL	27 66 n1...nk 0	1B 42 n1...nk 00	Set vertical tab stops	41
ESC C NUL n	27 67 0 n	1B 43 00 n	Set form length by inches	48
ESC C n	27 67 n	1B 43 n	Set form length by lines	48
ESC D n1...nk NUL	27 68 n1...nk 0	1B 44 n1...nk 00	Set horizontal tab stops	40
ESC E	27 69	1B 45	Begin emphasized printing	21
ESC F	27 70	1B 46	End emphasized printing	21
ESC G	27 71	1B 47	Begin enhanced printing	21
ESC H	27 72	1B 48	End enhanced printing	21
ESC I n	27 73 n	1B 49 n	Print control codes as characters	37
ESC J n	27 74 n	1B 4A n	Fine line feed	45
ESC K n1 n2 [graphics data]	27 75 n1 n2 [graphics data]	1B 4B n1 n2 [graphics data]	Begin single density graphics	63

Epson Code	Decimal	Hexadecimal	Function	Page
ESC L nl n2 [graphics data]	27 76 nl n2 [graphics data]	1B 4C nl n2 [graphics data]	Begin double density graphics	63
ESC M	27 77	1B 4D	Begin 12 cpi	23
ESC N n	27 78 n	1B 4E n	Skip over perforation	48
ESC O	27 79	1B 4F	Reset skip over perforation to default	49
ESC P	27 80	1B 50	Begin 10 cpi	23
ESC Q n	27 81 n	1B 51 n	Set right margin	38
ESC R n	27 82 n	1B 52 n	Select international character set	33
ESC S n	27 83 n	1B 53 n	Begin superscript/subscript	30
ESC T	27 84	1B 54	End superscript/subscript	30
ESC U n	27 85 n	1B 55 n	Unidirectional printing	52
ESC W n	27 87 n	1B 57 n	Double width printing	25
ESC Y nl n2 [graphics data]	27 89 nl n2 [graphics data]	1B 59 nl n2 [graphics data]	Begin high speed double density graphics	63
ESC Z nl n2 [graphics data]	27 90 nl n2 [graphics data]	1B 5A nl n2 [graphics data]	Begin quadruple density graphics	63
ESC \nl n2	27 92 nl n2	1B 5C nl n2	Relative horizontal dot position	44
ESC ^ m nl n2 [graphics data]	27 94 m nl n2 [graphics data]	1B 5E m nl n2 [graphics data]	Begin 9-pin graphics	64
ESC a n	27 97 n	1B 61 n	Justification	39
ESC b n m1...mk NUL	27 98 n m1...mk 0	1B 62 n m1...mk 00	Set vertical tabs for channel n	42
ESC j n	27 106 n	1B 6A n	Reverse n/216 inch line feed	45
ESC k n	27 107 n	1B 6B n	Select typeface	22
ESC l n	27 108 n	1B 6C n	Set left margin	38
ESC p n	27 112 n	1B 70 n	Proportional spacing	24
ESC s n	27 115 n	1B 73 n	Printing speed	52

Epson Code	Decimal	Hexadecimal	Function	Page
ESC t n	27 116 n	1B 74 n	Select italics/graphics characters	35
ESC w n	27 119 n	1B 77 n	Double height printing	27
ESC x n	27 120 n	1B 78 n	Select NLQ/Utility print quality	20
DEL	127	7F	Delete	51

IBM Code Index

This index includes commands for the Proprinter II/Proprinter XL emulation.

IBM code	Decimal	Hexadecimal	Function	Page
BS	8	08	Backspace	50
HT	9	09	Horizontal tab	40
LF	10	0A	Line feed	45
VT	11	0B	Vertical tab	41
FF	12	0C	Form feed	48
CR	13	0D	Carriage return	50
SO	14	0E	Begin one-line double width printing	25
SI	15	0F	Begin compressed printing	26
DC1	17	11	End print suppress mode	54
DC2	18	12	Begin 10 cpi	23
DC4	20	14	End one-line double width printing	25
CAN	24	18	Clear buffer	51
ESC EM I	27 25 73	1B 19 49	Insert page	55
ESC EM R	27 25 82	1B 19 52	Eject page	55
ESC ! n	27 33 n	1B 21 n	Select international character set	33
ESC # 0	27 35 48	1B 23 30	Select high speed draft	20
ESC $	27 36	1B 24	Copy ROM characters to RAM	70
ESC % B n1 n2 n3 n4	27 37 66 n1 n2 n3 n4	1B 25 42 n1 n2 n3 n4	Indent from left margin	44
ESC % G	27 37 71	1B 25 47	Begin italics	22
ESC % H	27 37 72	1B 25 48	End italics	22

IBM Code	Decimal	Hexadecimal	Function	Page
ESC - n	27 45 n	1B 2D n	Underlining	29
ESC 0	27 48	1B 30	Begin $^{1}/_{8}$ line inch spacing	46
ESC 1	27 49	1B 31	Begin $^{7}/_{72}$ inch line spacing	46
ESC 2	27 50	1B 32	Begin variable line spacing	47
ESC 3 n	27 51 n	1B 33 n	Begin fine line spacing	47
ESC 4	27 52	1B 34	Set top of form	49
ESC 5 n	27 53 n	1B 35 n	Automatic line feed	51
ESC 6	27 54	1B 36	Select IBM Character Set II	35
ESC 7	27 55	1B 37	Select IBM Character Set I	35
ESC 8	27 56	1B 38	Turn off paper-out sensor	54
ESC 9	27 57	1B 39	Turn on paper-out sensor	54
ESC :	27 58	1B 3A	Begin 12 cpi	23
ESC = c1 c2 m n [character data]	27 61 c1 c2 m n [character data]	1B 3D c1 c2 m n [character data]	Download custom character	70
ESC A n	27 65 n	1B 41 n	Set variable (n/72 inch) line spacing	46
ESC B n1...nk NUL	27 66 n1...nk 0	1B 42 n1...nk 00	Set vertical tab stops	41
ESC C NUL n	27 67 0 n	1B 43 00 n	Set form length by inches	48
ESC C n	27 67 n	1B 43 n	Set form length by lines	48
ESC D n1...nk NUL	27 68 n1...nk 0	1B 44 n1...nk 00	Set horizontal tab stops	40
ESC E	27 69	1B 45	Begin emphasized printing	21
ESC F	27 70	1B 46	End emphasized printing	21
ESC G	27 71	1B 47	Begin enhanced printing	21

IBM Code	Decimal	Hexadecimal	Function	Page
ESC H	27 72	1B 48	End enhanced printing	21
ESC I n	27 73 n	1B 49 n	Print mode combinations	30
ESC J n	27 74 n	1B 4A n	Fine line feed	45
ESC K n1 n2 [graphics data]	27 75 n1 n2 [graphics data]	1B 4B n1 n2 [graphics data]	Begin single density graphics	63
ESC L n1 n2 [graphics data]	27 76 n1 n2 [graphics data]	1B 4C n1 n2 [graphics data]	Begin double density graphics	63
ESC N n	27 78 n	1B 4E n	Skip over perforation	48
ESC O	27 79	1B 4F	Reset skip over perforation to default	49
ESC P n	27 80 n	1B 50 n	Proportional spacing	24
ESC Q n	27 81 n	1B 51 n	Begin print suppress mode	54
ESC R	27 82	1B 52	Reset horizontal and vertical tabs to default	43
ESC S n	27 83 n	1B 53 n	Begin superscript/subscript	30
ESC T	27 84	1B 54	End superscript/subscript	30
ESC U n	27 85 n	1B 55 n	Unidirectional printing	52
ESC V n	27 86 n	1B 56 n	Set character spacing	33
ESC W n	27 87 n	1B 57 n	Double width printing	25
ESC X n1 n2	27 88 n1 n2	1B 58 n1 n2	Set left and right margins	38
ESC Y n1 n2 [graphics data]	27 89 n1 n2 [graphics data]	1B 59 n1 n2 [graphics data]	Begin high speed double density graphics	63
ESC Z n1 n2 [graphics data]	27 90 n1 n2 [graphics data]	1B 5A n1 n2 [graphics data]	Begin quadruple density graphics	63
ESC [@ EOT NULL NULL NULL n1 n2	27 91 64 4 0 0 0 n1 n2	1B 5B 40 04 00 00 00 n1 n2	Double height and width printing	27
ESC \ n1 n2	27 92 n1 n2	1B 5C n1 n2	Select All Characters Set	36
ESC]	27 93	1B 5D	Reverse line feed	46

IBM Code	Decimal	Hexadecimal	Function	Page
ESC ^	27 94	1B 5E	Print one character in All Characters Set	36
ESC — n	27 95 n	1B 5F n	Overscore	29

Control Code Table

This table includes all emulations. The Emulation column is coded as follows:

E=Epson FX86e/FX286e
P=IBM Proprinter II/Proprinter XL

Function	Emulation	ASCII	Decimal	Hexadecimal	Page
Character style					
Select NLQ/Utility print quality	E	ESC x n	27 120 n	1B 78 n n=1: NLQ n=0: Utility	20
Select high speed draft	P	ESC # 0	27 35 48	1B 23 30	20
Select high speed draft	E	ESC (n	27 40 n	1B 28 n	20
Begin emphasized printing	E P	ESC E	27 69	1B 45	21
End emphasized printing	E P	ESC F	27 70	1B 46	21
Begin enhanced printing	E P	ESC G	27 71	1B 47	21
End enhanced printing	E P	ESC H	27 72	1B 48	21
Select typeface	E	ESC k n	27 107 n	1B 6B n n=1: Sans Serif n=0: Courier	22
Begin italics	E	ESC 4	27 52	1B 34	22
End italics	E	ESC 5	27 53	1B 35	22
Begin italics	P	ESC % G	27 37 71	1B 25 47	22
End italics	P	ESC % H	27 37 72	1B 25 48	22
Character size					
Begin 10 cpi	E	ESC P	27 80	1B 50	23

Function	Emulation	ASCII	Decimal	Hexadecimal	Page
Begin 10 cpi	P	DC2	18	12	23
Begin 12 cpi	P	ESC :	27 58	1B 3A	23
Begin 12 cpi	E	ESC M	27 77	1B 4D	23
Proportional spacing	E	ESC p n	27 112 n	1B 70 n n=1: Begin proportional spacing n=0: End proportional spacing	24
Proportional spacing	P	ESC P n	27 80 n	1B 50 n n=1: Begin proportional spacing n=0: End proportional spacing	24
Double width printing	E P	ESC W n	27 87 n	1B 57 n n=1: Begin double width printing n=0: End double width printing	25
Begin one-line double width printing	E	ESC SO	27 14	1B 0E	25
Begin one-line double width printing	E P	SO	14	0E	25
End one-line double width printing	E P	DC4	20	14	25
Begin compressed printing	E P	SI	15	0F	26
Begin compressed printing	E	ESC SI	27 15	1B 0F	26
End compressed printing	E	DC2	18	12	26

Function	Emulation	ASCII	Decimal	Hexadecimal	Page
Double height printing	E	ESC w n	27 119 n	1B 77 n n=1: Begin double height printing n=0: End double height printing	27
Double height and width printing	P	ESC [@ EOT NULL NULL NULL n1 n2	27 91 64 4 0 0 0 n1 n2	1B 5B 40 04 00 00 00 n1 n2 n1=1, 2, 16, 17, 18, 32, 33, 34 n2=1,2	27
Print features					
Underlining	E P	ESC - n	27 45 n	1B 2D n n=1: Begin underlining n=0: End underlining	29
Overscore	P	ESC — n	27 95 n	1B 5F n n=1: Begin overscore n=0: End overscore	29
Begin superscript/ subscript	E P	ESC S n	27 83 n	1B 53 n n=1: Begin subscript n=0: Begin superscript	30
End superscript/ subscript	E P	ESC T	27 84	1B 54	30
Combined commands					
Print mode combinations	E	ESC ! n	27 33 n	1B 21 n	30
Print mode combinations	P	ESC I n	27 73 n	1B 49 n	30
Character spacing					
Set character spacing	P	ESC V n	27 86 n	1B 56 n n=0 to 11 dots	33
Set character spacing	E	ESC SPACE n	27 32 n	1B 20 n n=0 to 63 dots	33
Character sets					
Select international character set	E	ESC R n	27 82 n	1B 52 n	33

Function	Emulation	ASCII	Decimal	Hexadecimal	Page
Select international character set	P	ESC ! n	27 33 n	1B 21 n	33
Select IBM Character Set I	P	ESC 7	27 55	1B 37	35
Select IBM Character Set II	P	ESC 6	27 54	1B 36	36
Select italics/graphics characters	E	ESC t n	27 116 n	1B 74 n n=1: Graphics n=0: Italics	35
Select All Characters Set	P	ESC \ n1 n2	27 92 n1 n2	1B 5C n1 n2 n1, n2=0 to 255	36
Print one character in All Characters Set	P	ESC ^	27 94	1B 5E	36
Print control codes as characters	E	ESC I n	27 73 n	1B 49 n n=1: Control codes printed as characters n=0: Control codes function normally	37
Turn on control code character printing	E	ESC 6	27 54	1B 36	37
Turn off control code character printing	E	ESC 7	27 55	1B 37	37
Margins					
Set left margin	E	ESC l n	27 108 n	1B 6C n n=0 to 255 spaces	38
Set right margin	E	ESC Q n	27 81 n	1B 51 n n=1 to 255 spaces	38
Set left and right margins	P	ESC X n1 n2	27 88 n1 n2	1B 58 n1 n2 n1: Left margin n2: Right margin n1=0 to 254 spaces n2=1 to 255 spaces	38

Function	Emulation	ASCII	Decimal	Hexadecimal	Page
Justification	E	ESC a n	27 97 n	1B 61 n n=0: Left n=1: Center n=2: Right n=3: Full (left and right)	39
Tabs					
Set horizontal tab stops	E P	ESC D n1...nk NUL	27 68 n1...nk 0	1B 44 n1...nk 00 Epson: n=1 to 255 spaces k=1 to 32 IBM: n=1 to 65 spaces k=1 to 28	40
Horizontal tab	E P	HT	9	09	40
Set vertical tab stops	E P	ESC B n1...nk NUL	27 66 n1...nk 0	1B 42 n1...nk 00 Epson: k=1 to 16 n=0 to 255 lines IBM: k=1 to 64 n=0 to 65 lines	41
Vertical tab	E P	VT	11	0B	41
Select vertical tab channel	E	ESC / n	27 47 n	1B 2F n n=0 to 7	42
Set vertical tabs for channel n	E	ESC b n m1...mk NUL	27 98 n m1...mk 0	1B 62 n m1...mk 00 n=0 to 7 m=0 to 255 k=1 to 16	42
Reset horizontal and vertical tabs to default	P	ESC R	27 82	1B 52	43
Horizontal dot position					
Absolute horizontal dot position	E	ESC $ n1 n2	27 36 n1 n2	1B 24 n1 n2 n1=0 to 255 n2=0 to 3 n1+n2×256	44
Indent from left margin	P	ESC % B n1 n2 n3 n4	27 37 66 n1 n2 n3 n4	1B 25 42 n1 n2 n3 n4 n1, n2, n3, n4= 48 to 57 ASCII number	44

Function	Emulation	ASCII	Decimal	Hexadecimal	Page
Relative horizontal dot position	E	ESC \ n1 n2	27 92 n1 n2	1B 5C n1 n2 n1, n2= 0 to 255 n1+n2×256	44
Line feed					
Fine line feed	E P	ESC J n	27 74 n	1B 4A n n=0 to 255 Line feed is n/216 inch.	45
Line feed	E P	LF	10	0A	45
Reverse n/216 inch line feed	E	ESC j n	27 106 n	1B 6A n n=0 to 60	45
Reverse line feed	P	ESC]	27 93	1B 5D	46
Line spacing					
Begin $^{1}/_{6}$ inch line spacing	E	ESC 2	27 50	1B 32	46
Begin $^{1}/_{8}$ line spacing	E P	ESC 0	27 48	1B 30	46
Begin $^{7}/_{72}$ inch line spacing	E P	ESC 1	27 49	1B 31	46
Set variable (n/72 inch) line spacing	E P	ESC A n	27 65 n	1B 41 n IBM: n=0 to 255 Epson: n=0 to 85	46
Begin fine line spacing	E P	ESC 3 n	27 51 n	1B 33 n n=0 to 255 Spacing is n/216 inch.	47
Begin variable line spacing	P	ESC 2	27 50	1B 32 Activates spacing set by the ESC A command.	47
Forms control					
Set form length by inches	E P	ESC C NUL n	27 67 0 n	1B 43 00 n Epson: n=1 to 22 IBM: n=1 to 255	48
Form feed	E P	FF	12	0C	48
Set form length by lines	E P	ESC C n	27 67 n	1B 43 n Epson: n=0 to 127 IBM: n=0 to 255	48

Function	Emulation	ASCII	Decimal	Hexadecimal	Page
Skip over perforation	E P	ESC N n	27 78 n	1B 4E n Epson: n=0 to 127 lines IBM: n=0 to 255 lines	48
Reset skip over perforation to default	E P	ESC O	27 79	1B 4F	49
Set top of form	P	ESC 4	27 52	1B 34	49
Miscellaneous					
Carriage return	E P	CR	13	0D	50
Backspace	E P	BS	8	08	50
Clear buffer	E P	CAN	24	18	51
Reset	E	ESC @	27 64	1B 40	50
Delete	E	DEL	127	7F	51
Unidirectional printing	E P	ESC U n	27 85 n	1B 55 n n=1: Begin unidirectional printing n=0: Begin bidirectional printing	52
Automatic line feed	P	ESC 5 n	27 53 n	1B 35 n n=1: Activate auto line feed n=0: Deactivate auto line feed	51
One line unidirectional printing	E	ESC <	27 60	1B 3C	52
Set 8th data bit to 1	E	ESC >	27 62	1B 3E	53
Set 8th data bit to 0	E	ESC =	27 61	1B 3D	53
Cancel 8th bit control	E	ESC #	27 35	1B 23	53
Printing speed	E	ESC s n	27 115 n	1B 73 n n=1: Begin half speed printing n=0: Begin full speed printing	

Function	Emulation	ASCII	Decimal	Hexadecimal	Page
Turn on paper-out sensor	E P	ESC 9	27 57	1B 39	54
Turn off paper-out sensor	E P	ESC 8	27 56	1B 38	54
Begin print suppress mode	E	DC3	19	13	54
Begin print suppress mode	P	ESC Q n	27 81 3	1B 51 03	54
End print suppress mode	E P	DC1	17	11	54
Cut sheet feeder control					
Eject page	E P	ESC EM R	27 25 82	1B 19 52	55
Insert page	E P	ESC EM I	27 25 73	1B 19 49	55
Graphics					
Begin 8-pin bit-image graphics	E	ESC * m n1 n2 [graphics data]	27 42 m n1 n2 [graphics data]	1B 2A m n1 n2 [graphics data]	59
Begin single density graphics	E P	ESC K n1 n2 [graphics data]	27 75 n1 n2 [graphics data]	1B 4B n1 n2 [graphics data] n1, n2=0 to 255	63
Begin double density graphics	E P	ESC L n1 n2 [graphics data]	27 76 n1 n2 [graphics data]	1B 4C n1 n2 [graphics data] n1, n2=0 to 255	63
Begin high speed double density graphics	E P	ESC Y n1 n2 [graphics data]	27 89 n1 n2 [graphics data]	1B 59 n1 n2 [graphics data]	63
Begin quadruple density graphics	E P	ESC Z n1 n2 [graphics data]	27 90 n1 n2 [graphics data]	1B 5A n1 n2 [graphics data]	63

Function	Emulation	ASCII	Decimal	Hexadecimal	Page
Reassign graphics codes	E	ESC ? n m	27 63 n m	1B 3F n m n=K L Y or Z m=0 to 6	64
Begin 9-pin graphics	E	ESC ^ m n1 n2 [graphics data]	27 94 m n1 n2 [graphics data]	1B 5E m n1 n2 [graphics data]	64
Custom characters					
Copy ROM characters to RAM	E	ESC : NUL NUL NUL	27 58 0 0 0	1B 3A 00 00 00	67
Download custom characters	E	ESC & NUL n1 n2 d [character data]	27 38 0 n1 n2 d [character data]	1B 26 00 n1 n2 d [character data]	67
Select custom character set	E	ESC % n	27 37 n	1B 25 n n=1: Custom character set n=0: Standard character set	67
Copy ROM characters to RAM	P	ESC $	27 36	1B 24	70
Download custom character	P	ESC = c1 c2 m n [character data]	27 61 c1 c2 m n [character data]	1B 3D c1 c2 m n [character data] c1, c2, n =0 to 255 m=20 or 21	70

▶ Appendix B: Menu Selections

Note Factory settings are in red.

Group	Item	Settings
FONT	PRINT MODE	UTILITY, NLQ COURIER, NLQ SANS SERIF
	PITCH	10 CPI, 12 CPI, 15 CPI, 17.1 CPI, 20 CPI, PROPORTIONAL
	STYLE	NORMAL, ITALICS
	SIZE	SINGLE, DOUBLE
GENERAL CONTROL	EMULATION MODE	EPSON FXE, IBM PPR
	GRAPHICS PRINTING	UNI-DIRECTIONAL, BI-DIRECTIONAL
	PAPER OUT OVERRIDE	NO, YES
	PRINT REGISTRATION	0, -1, -2, -3, -4, -5, +5, +4, +3, +2, +1
	OPERATOR PANEL FUNCTIONS	FULL OPERATION, LIMITED OPERATION
VERTICAL CONTROL	LINE SPACING	6 LPI, 8 LPI
	FORM TEAR-OFF	OFF, ON
	SKIP OVER PERFORATION	NO, YES
	AUTO LF	NO, YES
	AUTO CR	NO, YES
	AUTO FEED XT	INVALID, VALID
	PAGE LENGTH	11″, 11⅔″, 12″, 14″, 3″, 3.5″, 4″, 5.5″, 6″, 7″, 8″, 8.5″

Group	Item	Settings
SYMBOL SETS	CHARACTER SET	SET I, SET II,
	LANGUAGE SET	AMERICAN, FRENCH, GERMAN, BRITISH, DANISH I, SWEDISH I, ITALIAN, SPANISH I, JAPANESE, NORWEGIAN, DANISH II, SPANISH II, LATIN AMERICAN, FRENCH CANADIAN
	ZERO CHARACTER	UNSLASHED, SLASHED
SERIAL I/F OPTION	PARITY	NONE, ODD, EVEN
	SERIAL DATA 7 OR 8 BITS	8, 7
	PROTOCOL	READY/BUSY, X-ON/X-OFF
	DIAGNOSTIC TEST	NO, YES
	BUSY LINE	SSD-, SSD+, DTR, RTS
	BAUD RATE	19200 BPS, 9600 BPS, 4800 BPS, 2400 BPS, 1200 BPS, 600 BPS, 300 BPS
	DSR SIGNAL	VALID, INVALID
	DTR SIGNAL	READY ON POWER UP, READY ON SELECT
	BUSY TIME	200 MILLISECONDS, 1 SECOND

▶ Appendix C: Character Sets

ASCII Character Set

Where the Epson width differs from IBM, it is printed second in the width column. Characters in red print only when the IBM All Characters set is selected.

Hex.	Dec.	Character	Width
00	0	NUL	12
01	1	SOH ☺	12
02	2	STX ☻	12
03	3	ETX ♥	12
04	4	EOT ♦	10
05	5	ENQ ♣	12
06	6	ACK ♠	12
07	7	BEL •	12
08	8	BS ◘	12
09	9	HT ○	12
0A	10	LF ◙	12
0B	11	VT ♂	12
0C	12	FF ♀	12
0D	13	CR ♪	12
0E	14	SO ♫	12
0F	15	SI ☼	12
10	16	DLE ►	12
11	17	DC1 ◄	12
12	18	DC2 ↕	12
13	19	DC3 ‼	12
14	20	DC4 ¶	12
15	21	NAK §	12
16	22	SYN ▬	12
17	23	ETB ↨	12
18	24	CAN ↑	12
19	25	EM ↓	12
1A	26	SUB →	12
1B	27	ESC ←	12
1C	28	FS ∟	12
1D	29	GS ↔	12
1E	30	RS ▲	12
1F	31	US ▼	12
20	32	(SPACE)	12
21	33	!	5
22	34	"	8
23	35	#	12
24	36	$	12
25	37	%	12
26	38	&	12
27	39	'	6, 5
28	40	(	6
29	41	)	6
2A	42	*	12
2B	43	+	12
2C	44	,	6, 7
2D	45	—	12
2E	46	.	6
2F	47	/	10
30	48	0	12
31	49	1	8
32	50	2	12
33	51	3	12
34	52	4	12
35	53	5	12
36	54	6	12
37	55	7	12
38	56	8	12
39	57	9	12
3A	58	:	6
3B	59	;	6
3C	60	<	10
3D	61	=	12

Hex.	Dec.	Character	Width
3E	62	>	10
3F	63	?	10, 12
40	64	@	12
41	65	A	12
42	66	B	12
43	67	C	12
44	68	D	12
45	69	E	12
46	70	F	12
47	71	G	12
48	72	H	12
49	73	I	8
4A	74	J	12, 11
4B	75	K	12
4C	76	L	12
4D	77	M	12
4E	78	N	12
4F	79	O	12
50	80	P	12
51	81	Q	12
52	82	R	12
53	83	S	12
54	84	T	12
55	85	U	12
56	86	V	12
57	87	W	12
58	88	X	10
59	89	Y	12
5A	90	Z	12, 10
5B	91	]	8
5C	92	\	10
5D	93	[	8
5E	94	^	12
5F	95	—	12
60	96	'	6, 5
61	97	a	12
62	98	b	11
63	99	c	11
64	100	d	11
65	101	e	12, 10
66	102	f	12, 10
67	103	g	11
68	104	h	12, 11
69	105	i	8
6A	106	j	8, 9
6B	107	k	10
6C	108	l	8
6D	109	m	12
6E	110	n	12, 11
6F	111	o	11, 12
70	112	p	11
71	113	q	11
72	114	r	11
73	115	s	12
74	116	t	10, 11
75	117	u	12
76	118	v	12
77	119	w	12
78	120	x	10
79	121	y	12
7A	122	z	10
7B	123	{	9
7C	124	|	4, 5
7D	125	}	9
7E	126	~	12
7F	127	DEL ⌂	12

IBM Character Sets I and II

In the Epson emulation, this range prints in Italics (ASCII) or in graphics. The Epson graphics set is the same as IBM character set II.
Characters in red print only when IBM character set II is selected.

Hex.	Dec.	Character		Width
80	128		Ç	12
81	129		ü	12
82	130		é	12
83	131		â	12
84	132		ä	12
85	133		à	12
86	134		å	12
87	135		ç	12
88	136	BS	ê	12
89	137	HT	ë	12
8A	138	LF	è	12
8B	139	VT	ï	9
8C	140	FF	î	10
8D	141	CR	ì	8
8E	142	SO	Ä	12
8F	143	SI	Å	12
90	144		É	12
91	145	DC1	æ	12
92	146	DC2	Æ	12
93	147	DC3	ô	11
94	148	DC4	ö	11
95	149		ò	11
96	150		û	12
97	151		ù	12
98	152	CAN	ÿ	11
99	153		Ö	11
9A	154		Ü	12
9B	155	ESC	¢	12
9C	156		£	12
9D	157		¥	12
9E	158		₧	12
9F	159		ƒ	12
A0	160		á	12
A1	161		í	12

Hex.	Dec.	Character	Width
A2	162	ó	12
A3	163	ú	12
A4	164	ñ	12
A5	165	Ñ	12
A6	166	ª	12
A7	167	º	12
A8	168	¿	12
A9	169	⌐	12
AA	170	¬	12
AB	171	½	12
AC	172	¼	12
AD	173	¡	12
AE	174	«	12
AF	175	»	12
B0	176	░	12
B1	177	▒	12
B2	178	▓	12
B3	179	│	12
B4	180	┤	12
B5	181	╡	12
B6	182	╢	12
B7	183	╖	12
B8	184	╕	12
B9	185	╣	12
BA	186	║	12
BB	187	╗	12
BC	188	╝	12
BD	189	╜	12
BE	190	╛	12
BF	191	┐	12
C0	192	└	12
C1	193	┴	12
C2	194	┬	12
C3	195	├	12

Hex.	Dec.	Character	Width
C4	196	─	12
C5	197	┼	12
C6	198	╞	12
C7	199	╟	12
C8	200	╚	12
C9	201	╔	12
CA	202	╩	12
CB	203	╦	12
CC	204	╠	12
CD	205	═	12
CE	206	╬	12
CF	207	╧	12
D0	208	╨	12
D1	209	╤	12
D2	210	╥	12
D3	211	╙	12
D4	212	╘	12
D5	213	╒	12
D6	214	╓	12
D7	215	╫	12
D8	216	╪	12
D9	217	┘	12
DA	218	┌	12
DB	219	█	12
DC	220	▄	12
DD	221	▌	12
DE	222	▐	12
DF	223	▀	12
E0	224	α	12
E1	225	ß	12

Hex.	Dec.	Character	Width
E2	226	Γ	11
E3	227	π	12
E4	228	Σ	12
E5	229	σ	12
E6	230	μ	12
E7	231	τ	11
E8	232	Φ	12
E9	233	Θ	12
EA	234	Ω	12
EB	235	δ	12
EC	236	∞	12
ED	237	φ	12
EE	238	ε	10
EF	239	∩	12
F0	240	≡	12
F1	241	±	12
F2	242	≥	10
F3	243	≤	10
F4	244	⌠	12
F5	245	⌡	12
F6	246	÷	12
F7	247	≈	11
F8	248	°	8
F9	249	•	6
FA	250	·	6
FB	251	√	12
FC	252	η	10
FD	253	²	8
FE	254	■	8
FF	255	(SPACE)	12

▶ Appendix D: Interfacing

This appendix will help you design a SHIELDED interface cable that connects your printer to your computer. This requires some knowledge of electronics—signals, wiring, soldering, and crimping—to be designed properly. If you're not technically oriented, we recommend that you purchase a SHIELDED interface cable from your dealer.

Parallel Interfacing

The printer requires a Centronics-equivalent parallel cable with the following:

- Amphenol 57-30360 or AMP 552274-1 plug (or equivalent) with 36 pins
- AMP 552073-1 (or equivalent) cover
- Beldon (or equivalent) SHIELDED cable with twisted pair conductors. It can't exceed 1.8 meters in length and must be UL and CSA approved. The cable MUST be shielded.

Signals for Pin Assignments (Parallel):

Pin #	Signal	Return Pin #	Direction
1	Strobe	19	To Printer
2	Data 1	20	To Printer
3	Data 2	21	To Printer
4	Data 3	22	To Printer
5	Data 4	23	To Printer
6	Data 5	24	To Printer
7	Data 6	25	To Printer
8	Data 7	26	To Printer
9	Data 8	27	To Printer
10	Acknowledge	28	From Printer
11	Busy	29	From Printer
12	Paper end	30	From Printer
13	Select	No Return	From Printer
14	Autofeed	—	To printer
15	Not used	—	—
16	0V	No Return	Signal Ground
17	Chassis Gnd	No Return	Ground
18†	+5V*	—	From Printer
19-30	0V	—	Ground
31	I-Prime	—	To Printer
32	Fault	—	From Printer
33	0V	—	Signal Ground
34-36	Not Used	—	—

*50mA maximum

†Pin 18 is controlled by a jumper plug in the printer.

RS232-C Serial Interfacing

To construct a cable for an RS232-C serial configuration, you will need:

- DB25P equivalent 25-pin plug, shell equivalent to DB-C2- J9.
- Beldon (or equivalent) SHIELDED cable with twisted pair conductors. Must be UL and CSA approved. The cable MUST be shielded.
- The printer has a 25-pin DB-25S receptacle.

Signals for Pin Assignments (RS232-C serial):

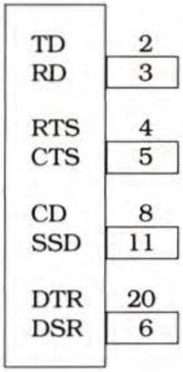
Pin #	Signal	Symbol	Direction
1	Protective ground	PG	—
2	Transmitted data	TD	From printer
3	Received data	RD	To Printer
4	Request to send	RTS	From Printer
5	Not used	—	—
6	Data set ready	DSR	To Printer
7	Signal ground	SG	—
8-10	Not used	—	—
11	Supervisory send data	SSD	From Printer
12-19	Not used	—	—
20	Data terminal ready	DTR	From Printer
21-25	Not used	—	—

Note See the Appendix of your Setup Guide for information on menu settings for the serial interface.

Local Tests: Serial Interface

After you've configured an interface cable for your computer and printer, you may want to spend a few extra minutes making a test connector. This test connector can be used to monitor the operation of the interface. Simply follow these instructions for your serial interface.

Jumper the following pins:



RS232-C (DB 25P Plug)

Place the printer in the circuit test mode by specifying "Yes" in response to the menu item DIAGNOSTIC TEST. Now you can run the local test:

1. Plug the test connector into the serial interface receptacle.
2. Turn the printer ON. The serial interface will check the memory function of the printer's message buffer, the interface driver and the receiver circuit, and then print all the characters in a test pattern.
3. This test can be stopped either by turning the printer OFF or by pressing the SELECT button.

4. This is what happens during the test:
   - The printer prints this message: "LOOP TEST"
   - The printer checks the memory function of the message buffer, then prints "OK" if the memory check is good, or "BAD" if the memory check is faulty.
   - The signal logic is checked, and if this is faulty, "IF BAD" is also printed.

Note If "BAD" is printed, call your dealer for assistance.

   - Hexadecimal characters from 20 to 7F are transmitted through the TD (Transmit Data) line, and received through the RD (Receive Data) line, then written to the message buffer. The above stored data is then printed.
   - This process repeats until the printer is turned OFF or until you press the SELECT button.

5. To restore normal operation, turn the printer off, then, while holding down the MODE button, turn the printer back on. The printer will now be in menu mode; simply step through the menu in the normal way and change the DIAGNOSTIC TEST setting to "No."

Appendix E: Specifications

Print method	Impact dot matrix
Printhead	9 pin
Print speed	
High Speed Draft	300 cps (characters per second)
Utility	250 cps
NearLetter Quality	62.5 cps

Characters per line	**ML320**	**ML321**
at 10 cpi	80	136
at 12 cpi	96	163
at 17.1 cpi	137	233
at 20 cpi	160	272

Reliability	
Mean Time Between Failures (MTBF)	5000 hours @ 25% duty cycle, 35% page density
Mean Time To Repair (MTTR)	15 minutes
Printhead life	200 million characters
Ribbon life	3 million characters
Electrical characteristics	
Voltage	120 V AC +5.5% -15% 220/240 V AC (special order)
Frequency	50/60 Hz ± 2%
Interface	Centronics parallel standard RS232C serial optional

Dimensions	**ML320**	**ML321**
Size	13.6″ deep 15.7″ wide 4.6″ high	13.6″ deep 21.7″ wide 4.6″ high
Weight	16 lb.	20 lb.

Paper specifications	
Width	3″ to 10″ (ML320) 3″ to 16″ (ML321)
Continuous forms	
Single part forms	
Weight	12 to 24 lb.
Thickness	0.0020″ to 0.0049″
Multpart—carbon lined or pressure sensitive	
Weight	9 to 11 lb.
Number of copies	Original plus 4 copies
Thickness	0.014″ max.
Multipart—interleaf	
Weight	Paper: 10 to 12 lb. Carbon: 9 lb.
Number of copies	Original plus 4 copies
Thickness	0.014″ max.
Cut sheets (single part only)	
Friction feed	
Weight	12 to 24 lb.
Thickness	0.002″ to 0.0049″
With CSF 3000	
Weight	16 to 24 lb.
Thickness	0.0027″ to 0.0049″
Envelopes (individual)	
Weight	24 lb. max.
Thickness	0.016″ max.
Dimensions	6½″ × 3⅝″ 8⅞″ × 3⅞″ 9½″ × 4⅛″
Card stock	
Weight	120 lb. max.
Thickness	0.009″ max.
Dimensions	5″ × 8″ max.

Use with bottom feed only.
Set head gap at position 2 for 120 lb. card stock.

Labels

Carrier width	8⅕″ max. (ML320) 15″ max. (ML321)
Total thickness	0.011″ max.

Use bottom feed only.
Do not use fabric labels.
Do not print on the edge or perforation of the label.

Transparencies

Thickness	0.004″ max.
Dimensions	8½″ W × 11″ L

Specifications subject to change without notice.

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Federal Communications Commission Radio Frequency Interference Statement

WARNING: This equipment complies with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules. These specifications are designed to minimize radio frequency interference in a residential installation; however, there is no guarantee that radio or television interference will not occur in any particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on when the radio or television is on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the radio or television receiving antenna.
- Relocate the printer with respect to the receiver.
- Move the printer away from the receiver.
- Plug the printer into a different outlet so that the printer and receiver are on different circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communication Commission helpful:

"How to Identify and Resolve Radio/TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402 by ordering stock number 004-000-00345-4.

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